Environmental Assessment

for

East Converse

Exploratory Oil and Gas Development Project

Bureau of Land Management

Casper Field Office

Casper, Wyoming

WY-060-EA12-227

November 2012

BLM

Wyoming High Plains District – Casper Field Office

TABLE OF CONTENTS

List of Appendix

List of Tables

List of Maps

List of Figures

ACRONYMS AND ABBREVIATIONS

ACHP	Advisory Council on Historic Preservation
AO	Authorized officer
APD	Application for permit to drill
AST	Aboveground storage tanks
AQRV	Air quality-related values
AUM	Animal unit months
BLM	Bureau of Land Management
BLS	Below land surface
BMP	Best management practices
CA	Communitization agreements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CEQ	Council on Environmental Quality
CFO	Casper Field Office
CFR	Code of Federal Regulations
cm	Centimeters
CH_4	methane
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_{2e}	Carbon dioxide equivalent
COA	Condition of Approval
CSU	Controlled surface use
DDCT	Density disturbance calculation tool
DEQ	Department of Environmental Quality
DO	District office (High Plains)
DR	Decision record
EA	Environmental assessment
EO	Executive order
EIS	Environmental impact statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act of 1973
FEIS	Final environmental impact statement
FLPMA	Federal Land Policy and Management Act of 1976
FOOGLRA	Federal Onshore Oil and Gas Leasing Reform Act of 1987
FONSI	Finding of no significant impact
FWS	Fish and Wildlife Service
GHG	Greenhouse gas
GIS	Geographic information system
HFC	Hydrofluorocarbon
INPS	Invasive, non-native plant species
IMPROVE	Interagency monitoring of protected visual environments

IPMP	Integrated pest management plan
MBTA	Migratory Bird Treaty Act of 1918
MD	Measured depth
mm	Million
mmt	Million metric tons
MLA	Mineral Leasing Act of 1920
MOU	Memorandum of understanding
N_2O	Nitrous oxide
NO_2	Nitrogen dioxide
NADP	National acid deposition program
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act of 1976
NFO	Newcastle Field Office
NHPA	National Historic Preservation Act of 1966
NOS	Notice of staking
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSO	No surface occupancy
O_3	Ozone
Pb	Lead
PFC	Perfluorocarbons
PFYC	Potential fossil yield classification
$PM_{2.5}$	particulates finer than 2.5 microns in effective diameter
PM_{10}	particulates finer than 10 microns in effective diameter
PRRA	Platte River Resource Area
PUP	Pesticide utilization proposal
RCRA	Resource Conservation and Recovery Act of 1976
RFFA	Reasonable foreseeable future actions
RMP	Resource management plan
ROD/RMP	Record of Decision and Approved Casper Resource Management Plan
ROW	Right-of-way
SF_6	Sulfur hexafluoride
SHPO	State Historic Preservation Office
SLAMS	State and local monitoring site
SO_2	Sulfur dioxide
SPCC	Spill prevention, control, and countermeasure
SVR	Support vector regression
SWPPP	Storm water pollution prevention plan
T&E	Threatened and endangered
TBNG	Thunder Basin National Grassland
USC	United States Code
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
VRM	Visual resource management

WAAQS	Wyoming Ambient Air Quality Standards
WARMS	Wyoming air resource monitoring system
WDEQ	Wyoming Department of Environmental Quality
WDEQ/AQD	Wyoming Department of Environmental Quality/Air Quality Division
WDEQ/LQD	Wyoming Department of Environmental Quality/Land Quality Division
WGFD	Wyoming Game and Fish Department
WRAP	Western Regional Air Partnership
WSEO	Wyoming State Engineer's Office
WOGCC	Wyoming Oil and Gas Conservation Commission
WSO	Wyoming State Office
WWDC	Wyoming Water Development Commission
WYDOT	Wyoming Department of Transportation

CHAPTER 1: INTRODUCTION

The Bureau of Land Management (BLM), Casper Field Office (CFO), is proposing the exploration of hydrocarbon resources in eastern Converse and western Niobrara counties, in response to several notices of staking (NOS) and applications for permit to drill (APD) recently received from three oil and gas operators. The project area consists of approximately 196 square miles and 125,520 acres.

The project proposal is for 18 new well pads that would accommodate 21 wells using all known drilling techniques including, but not limited to, vertical, directional, and horizontal. The project proposal also includes installing equipment necessary to produce the resource if it proves to be commercially productive.

This environmental assessment (EA) WY-060-EA12-227, also referred to as East Converse EA was prepared by the BLM, CFO to disclose and analyze the potential impacts that could result from implementation of the Proposed Action or other alternatives.

EAs assist the BLM in project planning and compliance with the National Environmental Policy Act (NEPA). They also assist the authorized officer (AO) in making an informed determination as to whether any significant impacts could result from the analyzed actions. Significance is defined by the Council on Environmental Quality (CEQ) and is found in regulation Title 40 Code of Federal Regulations (CFR) 1508.27.

An EA provides evidence for determining whether to prepare an environmental impact statement (EIS) or to support a "Finding of No Significant Impact" (FONSI). If the decision maker determines that this project has significant impacts following the analysis in the EA, then an EIS would be prepared for the project. A FONSI documents the reasons why implementation of the selected alternative would not result in "significant" environmental impacts (effects). When a FONSI statement is reached, a Decision Record (DR) may be signed approving the selected alternative, which could be the proposed action, another alternative, or a combination thereof.

Background

In accordance with the Federal Land Policy and Management Act of 1976 (FLPMA), as amended [43 USC. 1701 *et seq*.], BLM-administered public lands and federal minerals were identified for mineral leasing and when necessary stipulations for leasing, based on information available at the time, were made during the land use planning process. During the Casper Resource Management Plan (RMP) revision, federal minerals within the CFO administrative boundary were designated as being either 'open' or 'administratively unavailable' for future oil and gas leasing.

The BLM's policy derived from various laws, including the Mineral Leasing Act of 1920 (MLA), as amended [30 United States Code (USC.) 181 *et seq*.] and FLPMA, is to make federal mineral resources available for disposal and to encourage development of mineral resources to meet national, regional, and local needs.

As required under the MLA, the Federal Onshore Oil and Gas Leasing Reform Act of 1987 (FOOGLRA), Title 43 CFR 3120.1-2(a), and BLM Instruction Memorandum 2010-117, the BLM Wyoming State Office (WSO) conducts a quarterly competitive lease sale to sell available oil and gas lease parcels. Lease stipulations applicable to each parcel are specified in the sale notice, become part of the lease, and supersede inconsistent provisions of the standard lease form, pursuant to 43 CFR 3101.1-3, Stipulations and information notices.

Throughout this document, 'valid and existing rights' will be acknowledged. The term 'valid and existing (lease) rights', is defined below in accordance with BLM form 3100-11 Offer to Lease and Lease for Oil and Gas and 43 CFR 3101.1-2 Surface Use Rights. The NOSs and APDs that make up the proposed action and the other alternatives within this EA are applications submitted either by the lessees' and/or operators applications exercising their valid and existing lease rights.

In accordance with BLM Form 3100-11, Offer to Lease and Lease for Oil and Gas, leases for Oil and Gas are issued granting the exclusive right to drill for, mine, extract, remove and dispose of all the oil and gas (except helium) in the lands leased together with the right to build and maintain necessary improvements, typically for 10 years, subject to renewal or extension in accordance with the appropriate leasing authority. Rights granted are subject to applicable laws, the terms, conditions, and formal orders hereafter promulgated when not consistent with lease rights granted or specific provisions of the lease.

In accordance with 43 CFR 3101.1-2,

> A lessee shall have the right to use so much of the leases lands as necessary to explore for, drill, mine extract, remove and dispose of all the leased resource in a leasehold subject to: Stipulations attached to the lease; restrictions deriving from specific nondiscretionary statues; and such reasonable measures as may be required by the authorized officer to minimize adverse impacts to other resource values, land uses or users not addressed in the lease stipulations at the time operations are proposed. To the extent consistent with lease rights granted, such reasonable measures may include but are not limited to, modification to siting or design of facilities, timing or operations, and specification of interim and final reclamation measures. At a minimum, measures shall be deemed consistent with lease rights granted provided that they do not require relocation of proposed operations by more than 200 meters; require that operations be sited off the leasehold; or prohibit new surface disturbing operations for a period in excess of 60 days in any lease year.

Project Area and General Setting

The overall project area encompasses approximately 125,520 acres of mixed federal, state, and fee (private) surface estate (map 1). Of this total, the United States administers approximately 11,497 acres, 8,131 acres are lands administered by the state of Wyoming, and the remaining 105,892 acres are privately owned, as shown on map 1 and table 1.1.

Much of the project area is fee surface ownership. A few large federal parcels are scattered throughout the area, as well as some small isolated federal parcels. A few Thunder Basin National Grassland (TBNG) parcels are scattered in the extreme northern portion of the area. The TBNG were withdrawn and set aside for management by the US Forest Service (FS) under a series of executive orders (EO).

Of the 10,459 acres of BLM surface estate situated within the overall project area, the CFO administers 7,418 acres, with the remaining 3,041 acres administered by the Newcastle Field Office (NFO). Table 1.1 summarizes surface ownership within the project area.

Table 1.1. Surface Ownership within the Project Area

Surface Ownership	Acres	Percent of Project Area
Federal - administered by BLM, Casper FO	7,418	6
Federal - administered by BLM, Newcastle FO	3,041	2
Federal - administered by the Forest Service	1,038	<1
State of Wyoming (state)	8,131	6
Private (fee)	105,892	84
Total[a]	**125,520**	***100**
[a]May not be add due to rounding.		

The federal mineral estate comprises approximately 65% of the mineral estate within the project area; 88% of that has valid, existing lease rights with approximately 168 federal leases. Of those 168 federal leases, 102 (60%) are what is known as “held by production,” meaning they are currently producing oil and natural gas resources and will not expire until that production ceases. The remaining 66 (40%) federal leases are due to expire 10 years from date of issuance if a producing well is not located. Table 1.2 summarizes the mineral ownership.

Map 1
East Converse Project Area and Surface Ownership

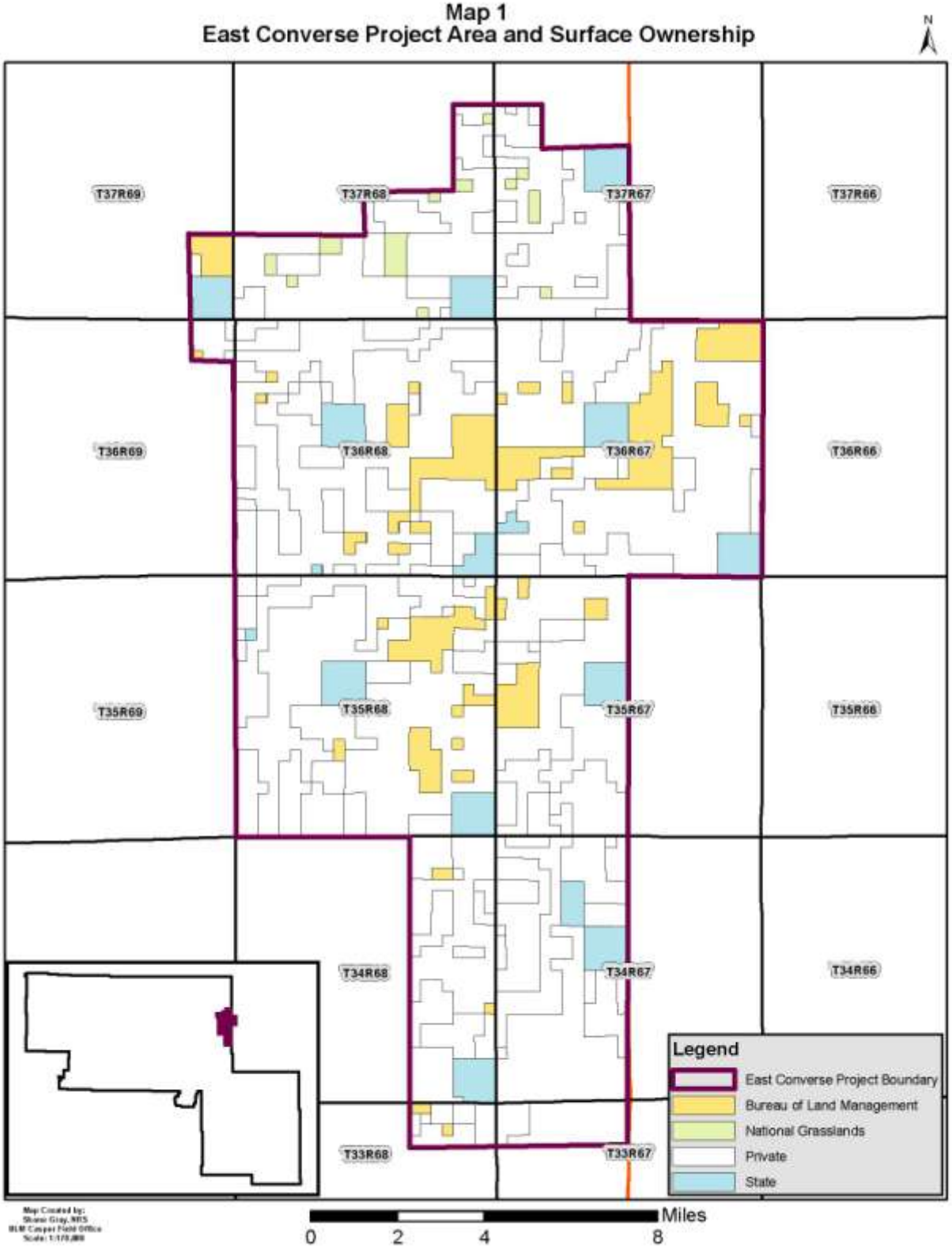


Table 1.2. Mineral Ownership within the Project Area

Mineral Ownership	Acres	Percent of Project Area
Federal	81,317	65
State of Wyoming (state)	8,131	6
Private (fee)	36,072	29
TOTAL	**125,520**	**100**

PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose of the action is to explore and develop oil and gas resources on federal mineral leases consistent with lease rights, where valid, existing rights occur.

The need for exploration and development of oil and gas resources is established by the BLM's responsibility under the MLA of 1920 (30 USC.188 *et seq.*), as amended to promote the mining of oil and gas on the public domain. Deposits of oil and gas owned by the United States are subject to disposition in the form and manner provided by the MLA, where applicable, through the land use planning process.

Decision to be Made

The BLM will decide whether or not to authorize oil and gas exploration and development activities on federal mineral leases and, if so, under what terms and conditions.

CONFORMANCE WITH BLM LAND USE PLANS

Pursuant to 40 CFR 1508.28 and 1502.21, this EA tiers to and incorporates by reference the information and analysis contained in the following two RMPs: the *Record of Decision and Approved Casper Resource Management Plan* (ROD/RMP) approved in December 2007 and the *Record of Decision and Approved Newcastle Resource Management Plan* approved in August 2000, including FEIS and/or RMP supplements or amendments, if any.

> Casper RMP/ROD: According to the Casper RMP/ROD, page 2-15, Goal MR: 2.1 states "Maintain oil and gas leasing, exploration, and development, while minimizing impacts to other resource values;" decision 2002 "Parcels nominated for potential oil and gas leasing will be reviewed. Any stipulations attached to these parcels will be the least restrictive needed to protect other resource values;" and decision 2004 "The Casper Field Office is open to mineral leasing, including solid leasables and geothermal, unless specifically identified as

> administratively unavailable for the life of the plan for mineral leasing. These open areas will be managed on a case-by-case basis." In addition, Appendix D - Oil and Gas Operations, Applications for Permit to Drill (APD) specified, "If necessary, site-specific mitigation can be added to the APD as a Condition of Approval (COA) for protection of surface and/or subsurface resource values in the vicinity of the proposed activity."

The Newcastle RMP established the following objective for oil and gas resources:

> Maintain or enhance opportunities for mineral exploration and development while maintaining other resource values.

The Newcastle RMP specified the following decision/ management action to achieve the above objective:

> Federal oil and gas leases will be issued with appropriate stipulations for protection of other resource values.
>
> Surface-disturbing and disruptive activities associated with all types of mineral exploration and development and with geophysical exploration will be subject to appropriate mitigation measures determined through, but not limited to, use of the Wyoming BLM Mitigation Guidelines (Appendix 1).
>
> Appendix 1 – Wyoming BLM Mitigation Guidelines for Surface-Disturbing and Disruptive Activities specified, "…These guidelines have been written in a format that will allow for (1) their direct use as stipulations, and (2) the addition of specific or specialized mitigation following the submission of a detailed plan of development or other project proposal, and an environmental analysis."

In accordance with 43 CFR 1610.5-3(a), the proposed action has been determined to be in conformance with both plans. The project area has been determined to be suitable for oil and gas leasing. The proposed activities with incorporated mitigation measures to reduce impacts to other resource values, is consistent with the land use decisions and resource management goals and objectives.

RELATIONSHIP TO STATUTES, REGULATIONS, PLANS, OR OTHER ENVIRONMENTAL ANALYSES

This EA has been prepared in accordance with NEPA and complies with all applicable regulations and laws passed subsequent thereto, including the CEQ regulations (40 CFR 1500-1508).

The proposed action and alternatives are consistent with other federal, state, and local laws, rules, and regulations. The operators would procure any required permits or easements prior to commencement of drilling operations and subsequent evaluation of the proposed wells as identified in table 1.3.

Surface disturbing and site specific authorizations for each individual action would be approved through the APD process and compliant with NEPA with Determinations of NEPA Adequacy (DNA) or Categorical Exclusions (CX).

Table 1.3. Required Federal, State, and Local Permits and Approvals

Agency	Permit, Approval, or Action
Bureau of Land Management	Approval of the individual A P D s for operations on federally owned mineral estate
US Fish and Wildlife Service	Conformance with the Endangered Species Act (ESA)
Wyoming Game and Fish Department (WGFD)	Coordination on impacts to wildlife and state sensitive species
Wyoming State Engineer	Approval of permit to appropriate ground/surface water for use in drilling operations
Wyoming Oil and Gas Conservation Commission	Approval of the individual state of Wyoming drilling permit applications
Affected private surface owners	Easements/agreements for surface- disturbing operations on privately owned surface estate
Rights-of-way and access to and from state highways	Easements/agreements for surface- disturbing operations on or affecting Wyoming Department of Transportation ROWs.
Rights-of-way and access to and from county roads	Easements/agreements for surface- disturbing operations on or affecting county ROWs.

SCOPING, PUBLIC INVOLVEMENT, AND ISSUES

On August 26, 2011, a press release was published soliciting comments for the Hornbuckle Oil and Gas EA, which analyzed 96 wells on 48 well pads in the Hornbuckle oil field, located in northern Converse County. After the 30-day comment period, only two comments were received, of which neither were substantive or objected to the project.

Due to the nature, scope, scale, and location of the Hornbuckle EA, it is expected that this action would render similar comments, so external public scoping was not conducted.

Internal scoping was performed with an interdisciplinary team of BLM specialists. In addition, multiple operator meetings were held jointly and separately to assist with projections of development, multiple well pad configurations and hydraulic fracturing related technology (a.k.a. fracturing, fracing, fracking, frac, frack). As a result of those meetings, an issue was raised that the technology of fracturing is often misconstrued. Several operators offered to work together to provide an industry prepared technology report on the process of fracturing for the BLM to use in their oil and gas drilling analysis. That report is included in this EA in its entirety as appendix A. It was also

used as part of the proposed action and alternative descriptions, and is referenced throughout the document.

CHAPTER 2: PROPOSED ACTION AND ALTERNATIVES

Introduction

This EA analyzes the impacts of the proposed action and the agency alternative when compared with the current condition and expected future condition in the absence of either alternative, and is referred to as the no action alternative.

In response to individual NOSs and APDs submitted to the CFO for approval, the submissions were plotted on a map using geographic information system (GIS). Three distinct geographical groupings emerged within Converse County.

The calculations throughout this analysis were based on actual numbers submitted with the NOS and APDs by operators. From those submissions, three separate EAs were created to analyze the potential impacts of the proposed actions and alternatives. Appendix B contains the actual submissions, which were used to calculate averages and used as assumptions in table 2.1.

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

No Drilling Alternative

A no drilling alternative to deny exploration and development was considered as the no action alternative. It was eliminated from detailed analysis because it does not meet the purpose and need and it would not fulfill requirements of FLPMA, MLA, or other existing laws or regulations recognizing all valid and existing rights.

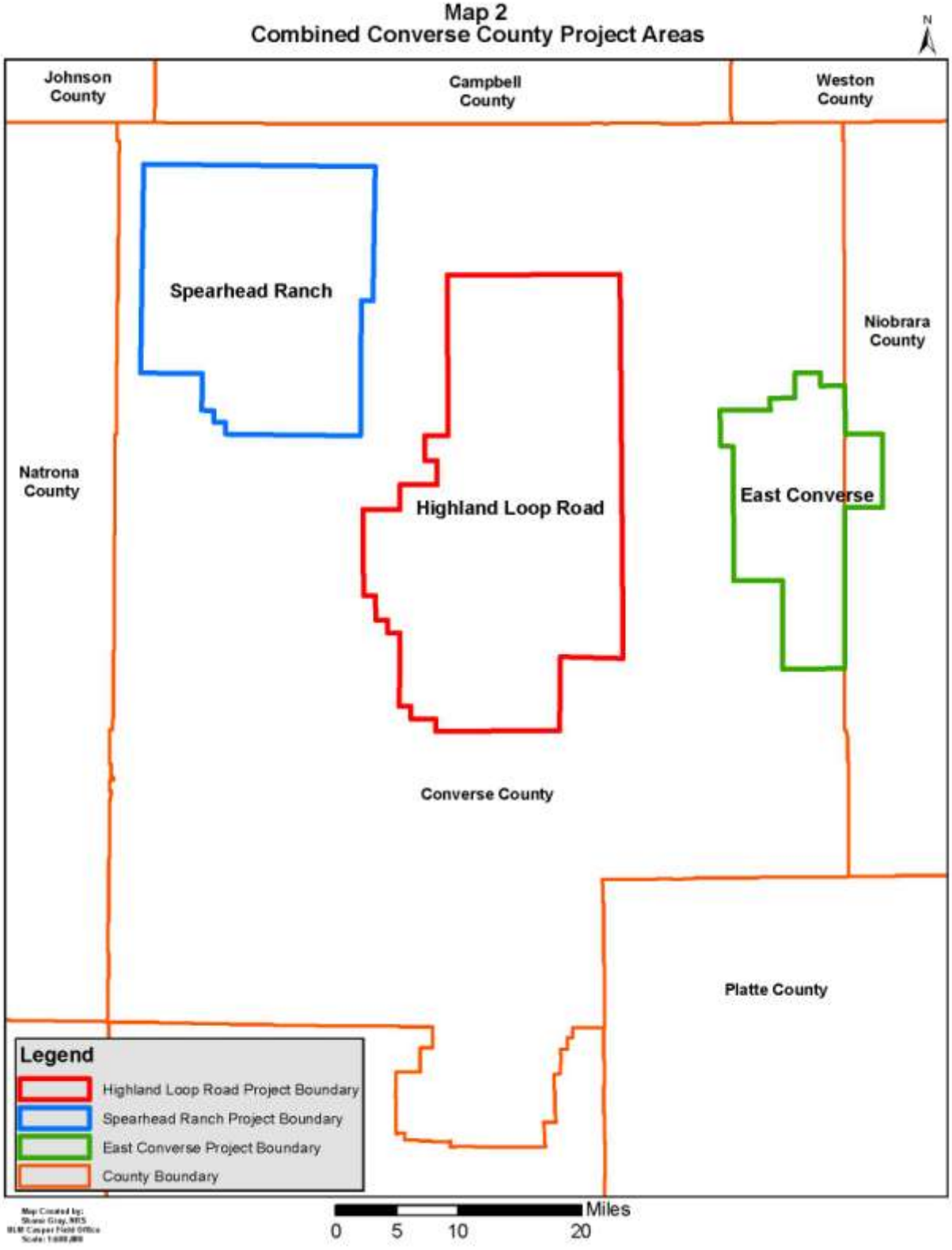
Combined Document Alternative

In response to the NOSs and APDs submitted to the CFO for approval, the submissions were plotted on a map using GIS as part of the interdisciplinary review process. As a result of that exercise three distinct geographical groupings emerged within Converse County (map 2).

Including the three geographical groupings (Spearhead Ranch, Highland Loop Road and East Converse) into one document was considered. It was eliminated from detailed analysis as a singular document for several reasons that may have made the analysis more extensive than it needed to be. Incorporating the submissions into one project boundary would have extended the project area out to include the majority of the county. While screening for resources that would likely be affected by the proposed actions it was determined that the distinct geographical groupings already avoided some resource concerns and the combined project area was too large in size and scale compared to the proposed actions and alternatives.

It was recognized that consideration of the combined proposed actions, alternatives and cumulative impacts of the three project areas would need to be analyzed. In an effort to include all the alternatives and all the project areas, the BLM has added a combined cumulative impacts analysis to each document that takes all three document details into

Map 2
Combined Converse County Project Areas



consideration. See table 4.4 in the combined cumulative impacts section of chapter 4, for incremental resource impacts of the combined project alternatives.

ALTERNATIVES CONSIDERED IN DETAIL

All three alternatives analyzed in detail would involve exploration and development of the federal oil and gas mineral resources using one or more of the techniques listed in detail below in project specifications and design. Because all the alternatives involve drilling, the proposed activities would be common to all alternatives.

Table 2.1 contains alternative specific assumptions and a side-by-side comparison of the alternatives. Table 2.1 shows the differences of the number of wells and associated well pads/locations between each alternatives and how those differences would equate to on-the-ground disturbance.

No Action Alternative

Under the no action alternative, the currently proposed 18 new well pads for a total of 21 wells within the project area would not be approved at this time. Additional NEPA analysis on a case-by-case basis, where valid and existing lease rights occur, would be required.

In accordance with the NEPA Handbook (H-1790-1) in Section 8.3.4.2, “Although the regulation at 40 CFR 1508.9(b) makes no specific mention of the No Action alternative with respect to EAs, the [Council on Environmental Quality] CEQ has interpreted the regulations generally to require some consideration of the a No Action alternative in an EA. The CEQ has issued guidance stating: “you may contrast the impacts of the proposed action and alternatives with the current condition and expected future condition in the absence of the project. This constitutes consideration of a no-action alternative as well as demonstrating the need for the project.”

In the absence of the proposed action and agency alternative, federal oil and gas mineral resources throughout the project area, would continue to be available for leasing, exploration, and development. NOSs, APDs, and PODs would require individual NEPA analyses on a case-by-case basis, where valid and existing lease rights occur.

The BLM cannot determine whether a lease will be drilled, explored or developed. In addition, the BLM cannot reasonably determine where companies will propose to develop wells on a given lease before the lessee files an NOS, APD, or a plan of development (POD). In an effort to quantify what the current and expected future condition in the absence of the project would resemble, the BLM looked at the project area, current leases and the status of those leases.

Production in sufficient quantities of some type of oil or gas is required, prior to expiration, for a lease to attain ‘held by production.’ Some leases may never be drilled and expire, some may be drilled but never reach commercial production quantities and expire, while others will produce commercial quantities and achieve held by production

status. With unknown drilling success and changing economic conditions, it would be speculative for the BLM to determine how many wells would be drilled.

For the purpose of this analysis, the BLM has identified that the current condition and expected future condition in the absence of the proposed action, would be at least the minimum amount of drilling consistent with valid and existing rights. Within the project area, there are 66 federal leases that have not achieved held by production status. At a minimum, these 66 leases would need approvals for one well per lease to retain their valid, existing lease rights.

Information submitted by the operators, indicate that 9 of those 66 leases (approximately 14%) would be involved as either a surface hole location, bottom hole location or a lateral transect as a result of the proposals. Even with this information, the BLM cannot predict if the wells identified in the proposed action will be productive or reach commercial quantities. It's possible that more than 66 wells will be drilled within the project area on a combination of leases not held by production and leases that are already held by production. However it is dependent on too many external factors to determine what that amount will be.

Throughout the project area federal oil and gas mineral resources would continue to be available for leasing, exploration, and development. If the no action alternative is chosen, NOS, APDs, and PODs would require individual NEPA analyses on a case-by-case basis.

Proposed Action

Under the proposed action, 18 new well pads within the project area would be constructed to accommodate drilling and completion operations for a total of 21 wells using multiple drilling techniques, including but not limited to vertical, directional, and horizontal.

Agency Alternative

Under the agency alternative, 18 well pads/ locations within the project area would be constructed to accommodate drilling and completion operations for a range of one to four wells per pad/ location utilizing multiple drilling techniques, including but not limited to vertical, directional, and horizontal, ultimately resulting in a range of 18 to 72 wells drilled within the project area.

Table 2.1. Comparison of Alternatives[ac]			
Components	**No Action**	**Proposed Action**	**Agency Alternative**
Ratio of well pad/locations to wells	Respond to individual APDs on a case-by-case basis. Potentially 66 new well locations could be processed, as 66 federal leases (40%) exist with valid and existing rights that are not currently held by production.	18 well pads for 21 wells. (15 single well pads and 3 two-well pads)	18 well pads with a range of 18 to 72 wells, assuming one to four wells per well pad/location.
Assumptions used for the well pad, well pad/location, and well pad excess disturbance calculations	Under this alternative, the per-well average and the per-well pad/location average is the same. This alternative assumes one well per well pad/location because federal leases with valid and existing lease rights allow for a minimum of one well per lease.	Under this alternative, the per-well average would be used for all the calculations based on actual submitted numbers by industry, as it is too cumbersome to calculate the averages for each multiple well pad size as proposed above.	This alternative uses the per-well average for the per-well pad/ location baseline, as the average four-well pad (based on actual submitted numbers by industry) equaled the average for the a one-well pad (as represented in the no action alternative).
Well pad and well pad/location acreage (+)	Average disturbance per well (assuming 1 well per pad/ location) is 4.21 acres. If 66 new wells were applied for and approved this alternative has the potential to yield a total of 277.86 acres of disturbance counting only the well pad.	Average disturbance per well (assuming well distribution among pads/location as listed above) would be 2.92 acres. If 21 new wells were approved on 18 pads/locations, this alternative has the potential to yield a total of 61.32 acres of disturbance counting only the well pad.	Average disturbance per well (assuming one to four wells per pad/ location) would be a range of 4.21 to 1.05 acres, respectively. If 18 to 72 new wells were approved on 18 well pad/locations this alternative would have the potential to yield a total of 75.78 acres of disturbance counting only the well pad.

Table 2.1. Comparison of Alternatives[ac]			
Components	**No Action**	**Proposed Action**	**Agency Alternative**
Well pad excess disturbance acreage (+)	Average disturbance per well or well pad/location for the construction area to build the pad, store topsoil, and spoil piles, and berm dirt from cut and fill, would be 2.11 acres. Total disturbance per well or well pad/location for the construction area to build the pad, store topsoil, and spoil piles, and berm dirt from cut and fill, would yield 139.26 acres.	Average disturbance per well for the construction area to build the pad, store topsoil and spoil piles, and berm dirt from cut and fill, would be 1.46 acres. Total disturbance per well for the construction area to build the pad, store topsoil and spoil piles, and berm dirt from cut and fill, would yield 30.66 acres.	Average disturbance per well pad/location for the construction area to build the pad, store topsoil and spoil piles, and berm dirt from cut and fill, would be 2.11 acres. Total disturbance per well pad/ location for the construction area to build the pad, store topsoil and spoil piles, and berm dirt from cut and fill, would yield 37.98 acres.
Assumptions used for the access roads and pipelines and utilities calculations	Under this alternative, the average of the per-well and the per-well pad/location would be the same, as the assumption is one well per pad/location.	Under this alternative, the per-well average would be used for the per-well pad/location baseline, as it assumes the benefit of co-locating wells and equipment on a multiple well pad is that only one access road, pipeline, and utility line, would be needed for each well pad/ location regardless of the number of wells on each pad.	For this alternative, the per-well average would be used for the per-well pad/location baseline, as it assumes the benefit of co-locating wells and equipment on a multiple well pad is that only one access road, pipeline, and utility line, would be needed for each well pad/ location regardless of the number of wells on each pad.

Table 2.1. Comparison of Alternatives[ac]			
Components	**No Action**	**Proposed Action**	**Agency Alternative**
Access roads acreage (+)	Average disturbance for access roads per well would be 4.62 acres. Total surface disturbance for access roads would yield 304.92 acres.	Average disturbance for access roads per well pad/location is 4.62 acres. The average per well would be 3.96 acres. Total surface disturbance for access roads would yield 83.16 acres for this alternative.	Average disturbance for access roads per well pad/location is 4.62 acres. The per-well average would range from 4.62 to 1.16 acres, respectively (18 to 72 wells). Total surface disturbance for access roads would yield 83.16 acres.
Pipelines and utilities acreage (+)	Pipeline and utility disturbances would average 3.75 acres per well or well pad/location. Total surface disturbance for pipelines and utilities has the potential to yield 247.50 acres, if 66 new well locations were applied for and approved.	Pipeline and utility disturbances would average 3.75 acres per well pad/location and 3.21 per well. Total surface disturbance for pipelines and utilities would yield 67.50 acres.	Pipeline and utility disturbances would average 3.75 acres per well pad/location and a per-well average would range from 3.75 to 0.94 acres, respectively (18 to 72 wells). Total surface disturbance for pipelines and utilities would yield 67.50 acres.
Short-term combined acreage (=)	Combined surface disturbance for construction, drilling, completion, and production would yield a total of 969.54 acres of short-term disturbance. The average short-term disturbance per well or well pad/ location (66) would be 14.69 acres.	Combined surface disturbance for construction, drilling, completion, and production would yield a total of 242.64 acres of short-term disturbance. The average short-term disturbance per well (21) would be 11.55 acres.	Combined surface disturbance for construction, drilling, completion, and production would yield a total of 264.42 acres of short-term disturbance. The average short-term disturbance per well (18 to 72 wells) would range from 14.69 to 3.67 acres, respectively.

Table 2.1. Comparison of Alternatives[ac]			
Components	**No Action**	**Proposed Action**	**Agency Alternative**
Reclamation standards assumptions (-)	This alternative assumes that 33% of each well pad/location, 50% of well pad excess, 0% of access roads, and 100% of the pipelines and utilities would be reclaimed. The reclaimed acreage would total 408.82 acres for all potential wells (66) with an average of 6.19 acres per well or well pad/location.	This alternative assumes that 33% of each well pad/location, 50% of well pad excess, 0% of access roads, and 100% of the pipelines and utilities would be reclaimed. The reclaimed acreage would total 103.07 acres with a per-well (21) average of 4.9 acres.	This alternative assumes that 33% of the well pad/location, 50% of well pad excess, 0% of access roads, and 100% of the pipelines and utilities would be reclaimed. The reclaimed acreage would total 111.50 acres; per well average (18 to 72 wells) would range from 6.19 to 1.55 acres, respectively.
Long-term combined acreage (=)	Long-term combined surface disturbance (short-term surface disturbance minus the reclam-ation standard assumptions) would yield 560.72 acres of long-term disturbance. The long-term combined disturbance would average 8.50 acres per well or well pad/ location (66).	Long-term combined surface disturbance (short-term surface disturbance minus the reclamation standard assumptions) would yield 139.57 acres of long-term disturbance. The long-term combined disturb-ance would average 6.65 acres per well (21).	Long-term combined surface disturbance (short-term surface disturbance minus the reclamation standard assumptions) would yield 152.92 acres of long-term disturbance. The long-term combined disturb-ance would be a range of 8.50 to 2.12 acres average per well respectively (18 to 72 wells).

[a]The per well average used in the this table is relevant to the surface disturbance calculations stated in table 23 of the reasonably foreseeable development (RFD) projections used to prepare the ROD/RMP.

[c] The values used in this table are assumptions, based on calculated averages. Actual disturbance, well pad size, and number of wells on a pad, may vary based on site-specific topography, distances, and targeted resources. However, the total authorized short and long term disturbances analyzed within this EA would not be exceeded.

COMMON TO ALL ALTERNATIVES

Project Specifications and Design

The details of the proposed activities are a compilation of the most commonly used techniques for drilling, completion, and operation of oil and gas wells to date. The details provided below may describe multiple ways to achieve the same outcome. This is to allow for the multiple operators' individual plans of operations and applications to be analyzed together within this document. There will only be one project proposal listed below, as all three alternatives analyzed in detail would involve exploration and development of the federal oil and gas mineral resources using one or more of the techniques listed below.

The exploration and subsequent development of federal mineral resources would involve drilling a combination of horizontal, directional, and vertical wells within the overall project area. Appendix C contains specific information regarding each geologic formation located within the project area. Specific surface locations for all of these wells have not been selected at this point but would generally consist of one horizontal well per section and would comply with well spacing requirements as prescribed by the Wyoming Oil and Gas Conservation Commission (WOGCC) for horizontal wells. Vertical well spacing is also governed by the state of Wyoming, which currently allows well densities of up to 16 wells per section (40 acre spacing) for those geologic formations above the Frontier Formation (above 11,000 feet) and one well per section (640 acre spacing) for those wells targeting the Frontier, Muddy, and Dakota formations below 11,000 feet.

Drilling operations would begin as soon as all of the necessary permits have been obtained (subject to any timing restrictions for the protection of wildlife on specific drilling permits). We anticipate that these wells would be drilled over a period of two to four years based on a combination of drilling success, rig availability, and market conditions.

If more than one well is identified for co-location on the same pad as another well, the timing of operations on subsequent wells would depend on several factors:

1. production rates and subsequent reservoir analyses on the initial well, and
2. lease issues including:

    a) lease expiration dates, and
    b) correlative rights where multiple leases are penetrated by a single well bore.

As wells are drilled within the field and additional reservoir data is gathered, we expect that operators would ultimately be able to drill multiple wells per pad. However, until operators have acquired sufficient reservoir information to determine the most efficient way to recover oil/gas reserves, we would expect a delay between the drilling of each subsequent well.

Production facilities for multiple wells would be consolidated to the greatest extent possible. Pursuant to both BLM and WOGCC rules and regulations, production from wells within a common lease or spacing unit either permitted or prescribed by governmental authority under an approved communitization agreement (or unit agreement may be commingled as per policy and regulation. However, wells located on a common pad that produce from different communitization agreements, unit agreements, or leases would be measured separately for royalty accounting purposes. The production from each well bore located on a common pad but developing a separate production unit or lease would be processed and stored separately from one another or accurately metered appropriately prior to commingling.
All lease operations would be conducted in full compliance with all applicable laws, regulations (43 CFR 3100 et al.), *Onshore Oil and Gas Orders*, the approved plan of operations and any applicable Notices to Lessees. Operations on federal lands would be conducted in compliance with 43 CFR 2800 et al.

Construction Activities

Construction activities for each proposed well location and access road route would follow practices and procedures outlined in each individual APD and any COAs appended thereto by the BLM. Access road and well pad construction activities would follow guidelines and standards outlined in the BLM/FS publication: *Surface Operating Standards for Oil and Gas Exploration and Development* (Fourth Edition) and/or the contractual requirements of any affected private (fee) surface owner(s).

Access Roads

Access to the project area would be obtained via state highways, county roads, and upgraded oilfield roads (crowned and ditched with gravel running surfaces) to the extent possible within the project area.

Access across any off-lease federal lands in conjunction with the proposed activities would require the approval of a separate right-of-way (ROW) application by the BLM's authorized officer

Whenever possible, access roads would be designed and constructed to disturb less than the 40 foot ROW, width so long as traffic and safety concerns could be satisfied. The existing access roads would be maintained as necessary to accommodate appropriate year-round traffic and prevent unnecessary erosion. Roads would be constructed in accordance with BLM manual section 9113 and/or the roading standards outlined in the joint BLM/USFS publication: *Surface Operating Standards for Oil and Gas Exploration and Development* (Fourth Edition) and would be designed by a professional engineer as necessary or where required by the BLM.

Rights-of-way for a variety of transportation purposes associated with oil and gas exploration and production are used to carry out the overall project. Roads provide access to well locations and production facilities; power lines provide electric service to

operate and produce oil and gas wells and related facilities. Pipelines facilitate economic transportation of oil and gas extracted from productive wells and produced water for disposal; and communication facilities can be used for health and safety purposes in the field and for coordination of operations.

Rights-of-way are required where federal lands traverse an operator's transportation facilities outside the boundaries of individual leases, communitization agreements (CA) or unit agreements (UA). Such facilities traversing public land within the lease, CA, or UA boundary are authorized under the terms of the lease, CA, or UA. Third-party owned transportation facilities traversing federal land require a ROW whether on or off the lease, CA, or UA. Where transportation facilities cross fee lands, a federal right-of-way is not required. An easement or agreement with the fee landowner secures permission for transportation facilities across those lands.

The corridor concept is intended to reduce the proliferation of separate rights-of-way by placing facilities in designated or established corridors, or adjacent to other facilities or surface disturbances. Application of the corridor concept is encouraged in FLPMA, and required by BLM planning decisions. Corridors are designated through the BLM land use planning process, and there are none located in the project area. Corridors established by use (i.e., existing or new facilities or disturbances) would be conformed to as corridors for facility placement purposes. Well access roads would be located in established corridors or on existing routes wherever possible. Where new well access roads are constructed, they would form the focus of the corridor established by use. Wherever possible, pipelines, power lines and other facilities would be placed parallel and adjacent to the well access road or other existing roads and facilities in corridor fashion. Because there are myriad complicating factors, rigid adherence to this ideal approach to corridors may not always occur. The location of existing infrastructure, topographic and other physical constraints, land ownership and other factors may dictate alternate routing for some or all right-of-way facilities for a given well. Case-by-case assessment and site layout would occur at the APD/NOS stage and would be refined at the onsite.

In most cases, there would be an oil production pipeline and a gas production pipeline placed parallel and adjacent to the well access road. A produced water pipeline may also be needed depending on the volume of water produced along with the hydrocarbons. Power lines may not be needed in the short-term but are usually desirable in the long term for more efficient field operations. Where radio, microwave, or cellular communications equipment is used, it is usually placed on the well location. Communications lines for individual wells are frequently needed, depending on individual company practices. When needed, these could be placed along the well access road as with other right-of-way facilities.

Generally, gathering pipelines of two to six inches in diameter can be constructed within a 20- to 30-foot wide right-of-way. When placed in a corridor along the well access road, the road could be used to accommodate much of the construction traffic, thus allowing a narrower pipeline construction width. Placing multiple pipelines parallel to

each other can have a cost saving benefit when construction space can be shared. A 60-foot wide ROW should accommodate three parallel pipelines—oil, gas, and produced water. Additional facilities such as power lines, whether overhead or buried, and telephone cables could be placed within this 60-foot wide footprint. An average 50-foot width should suffice for most access road construction on flat or gentle to moderately sloping terrain. Wider widths for large cut and fill slopes would be addressed case by case.

Each APD or NOS must identify the proposed access route to the well. Production pipelines and power lines should also be identified. The APD or NOS is screened to determine whether public land would be traversed and whether a right-of-way would be needed. If so, a right-of-way application is submitted and processed with the APD/NOS.

Well Locations

Major components of the proposed well pad would include:

- a leveled area suitable for placement/support of the drilling rig and related equipment; and,
- a series of up to three earthen reserve pits designed to contain the drilled cuttings and/or fluids to be used during the completion operation.

Construction activities for each well would follow practices and procedures outlined in each individual APD and any Conditions of Approval (COAs) appended by the BLM. Well pad construction activities would follow guidelines and standards as set forth in the joint BLM/U.S. Forest Service (USFS) publication: *Surface Operating Standards for Oil and Gas Exploration and Development* (Fourth Edition).

Sufficient topsoil used for revegetation would be segregated from subsoil materials and stockpiled for future reclamation of the disturbed areas. The stockpiles would be stabilized with vegetation until reclamation begins as necessary or required by either the private surface owner or the BLM. Upon termination of drilling and completion operations, the salvaged topsoil would be evenly distributed over those disturbed surfaces as part of the reclamation and revegetation program.

After the topsoil has been removed, the well pad would be graded to produce a level working platform around the drill hole(s) to support the rig substructure. The excavated soil material (subsoil) would be used in overall pad construction, with the finished well pad graded to allow for positive drainage of water away from the drill site.

The level area of the well pad required for drilling and completion operations would vary in size depending on the operator. Minor deviations would occur in the overall size of individual well locations due to topographic constraints and efforts by BLM, the operator and the private surface owners to limit surface disturbances in certain circumstances (including, but not limited to, areas of extensive cuts and/or fills, proximity to ephemeral drainages, etc.) as determined at the time of the on-site inspections. In addition to the

surface disturbance associated with the level pad area, additional surface disturbance would result from the cut/fill slopes associated with pad construction and topsoil/subsoil storage adjacent to the pad. Erosion control would be maintained through prompt revegetation and by constructing surface water drainage control structures such as berms, diversion ditches and waterbars as necessary on the proposed well location(s).

Prior to the commencement of drilling operations, the operator may be required to fence each individual well location on all four sides in order to protect wildlife and livestock. This fencing would be installed in accordance with guidelines contained in *Surface Operating Standards for Oil and Gas Exploration and Development (*Fourth Edition). The fencing would be maintained until the well(s) have been plugged and abandoned and the well location successfully reclaimed. Cattle guards or cattle guards with gates may be installed in the perimeter fence(s) if requested by the surface owner or BLM.

Drilling Operations

A site-specific description of drilling procedures for each well drilled would be included in the APD package the operator submitted to BLM and will be available at the BLM Casper Field Office. Drilling techniques could include vertical, directional, or horizontal drilling paths.

To drill the proposed wells, the operator would use a rotary drilling rig capable of drilling to the depths necessary for each individual well. Rig transport and on-site assembly would be completed in approximately seven days per well. Drilling times would vary depending on how long it took the operator to reach the proposed target depth. Horizontal wells would be drilled from the well pad location, vertically to a predetermined point above the target formation, referred to as the kick off point.

Appropriately sized pressure and well control equipment will be in place for all drilling activities. Drilling mud is specifically engineered and managed throughout the drilling operation to control the flow of fluids (water, oil, and gas) from the well bore. To make up the drilling mud, water would be hauled to each location from a commercial source, or obtained and transported from other sources, as identified in the APD package. Approximately 1,000 to 2,000 barrels of fresh water is used to make up the drilling mud used for each well. Drilling operations use both freshwater-based mud and oil-based drilling mud. Drilling mud may be reconditioned and reused for subsequent nearby wells on a case-by-case basis.

The operators may install a man camp within the overall project area to house drilling personnel at the time of well drilling and completion. Self-contained trailers could also be used on the individual well locations to house key personnel (drilling crews) during the drilling operation; however, these trailers would be temporary and would be removed following the termination of drilling and completion operations on each individual well.

Human waste and gray water generated during operations would be collected in either standard portable chemical toilets or portable service containers located on-site and

would be transported offsite to a state-approved wastewater treatment facility upon completion of operations. Non-human waste would be collected in enclosed containers and disposed of in a state-approved solid waste disposal facility.

For oil based mud drilling the operators could use a closed loop or semi-closed loop system to control solid and liquid during drilling operations. A combination of shale shakers, mud cleaners, and centrifuges (if necessary) would be used to segregate the drilled cuttings from the drilling fluids. The fluids would be returned to the mud tanks for continued use in the drilling operation. The segregated (semi-dry) cuttings would dump directly from the separation equipment into an open top steel mixing tank or a lined pit on location for solidification prior to temporary storage and ultimate disposal.
The drilling operation would use fresh water with additives to drill the surface hole. This system involves drilling with water and using non-hazardous additives such as bentonite to stabilize the hole and minimize down-hole sloughing. The specific source of this fresh water used in drilling operations for each well would be identified at the time the APD is submitted. Water transportation methods would also be identified in the APD package. Typical water transportation methods include temporary above-ground water lines from the water source location to the well location or haul truck from water source location to the well location using existing roads. Appropriate ROWs would be obtained as needed for access across any off-lease federal lands.

Waste and Hazardous Materials

Hazardous materials that would be used at the site may include drilling mud and cementing products, fuels, flammable or combustible materials, and corrosive acids and gels.

The Wyoming Department of Transportation (WYDOT) under 49 CFR 171–180, regulates transportation of hazardous materials to the well location. Potentially hazardous substances used in developing or operating wells would be kept in limited quantities on well sites and at the production facilities for short periods.

No chemicals that would be used to drill or produce the wells meet the criteria for an acutely hazardous material/substance or would exceed the quantities criteria required by BLM Instruction Memorandum No. 93-344.

In the event that hazardous or extremely hazardous materials or substances, as defined in 40 CFR 355, would be used, produced, stored, transported, or left on or near the operators project area, the operator would comply with all rules and regulations. These include, but are not limited to, reportable quantities of stored materials and reporting accidental release as set forth in 40 CFR 355. No chemicals subject to Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA) in amounts greater than 10,000 pounds would be stored on site.

All hazardous substances and commercial preparations would be handled in an appropriate manner to minimize the potential for leaks or spills. The operator would

develop and maintain a spill prevention, control, and countermeasure (SPCC) plan for each well site. Each SPCC plan would comply with the provisions of 40 CFR 112. Storage facilities and tanks would use secondary containment structures of sufficient capacity to contain, at a minimum, the entire contents of the largest tank with sufficient freeboard to contain precipitation after the well goes into production.

The concentration of nonexempt hazardous substances in the reserve pit at the time of pit backfilling would not exceed the standards set forth in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 42 USC 9605, as amended by the Superfund Amendments and Reauthorization Act of 1986, (PL 99-499). All oil and gas drilling-related CERCLA hazardous substances removed from a location and not reused at another drilling location would be disposed of in accordance with applicable federal and state regulations. {(Refer to 42 USC 9601(14) (Definition of "hazardous substances"); 42 USC 6921(2)(A)(exclusion of certain wastes associated with exploration and production); Environmental Protection Agency (EPA) Exploration and Production Wastes: Exemption from RCRA Subtitle C Regulation (May 1995)}. Only those hazardous wastes that qualify as **exempt,** under the Resource Conservation and Recovery Act (RCRA), Oil and Gas Exemption, would be disposed of in the reserve pit.

Casing and Cementing Operations

Surface casing would be set at an ~~approximate~~ appropriate depth and cemented back to the surface during the drilling operations. The surface casing would serve to support the well wall, prevent fluids from migrating between the different penetrated formations, and provide the mounting base for surface well control equipment. This could be accomplished either with a work-over rig before the drilling rig moves or with the drilling rig.

Intermediate casing would be set to a predetermined measured depth (MD) and would be cemented in place. Frequently, once the wellbore is drilled into the target formation, the intermediate casing is run and cemented. Occasionally, the well is drilled through the formation to its total planned depth before casing is run and cemented. In this case, the casing string run would also be the production casing. After the intermediate casing is run and cemented, the lateral or horizontal leg, of the wellbore is drilled in the formation until the total measured depth is reached. The production casing is run to the total measured depth and may or may not be cemented in the formation. The production casing may also have annular packers on it to compartmentalize the lateral section for completion. Another tool commonly used in conjunction with the production casing is frac sleeves in combination with the annular packers or cement. The cementing operations would be conducted in full compliance with *Onshore Oil and Gas Order Number 2*.

Completion Operations

After the well is drilled, cased, and cemented, the drilling rig would be moved off location, a completion rig would be moved onto the well, and additional equipment is moved onto location. The location is reset to accommodate the completion activities, and facilities may be constructed at this time. These completion operations would typically consist of cleaning out the well bore, pressure testing the casing, perforating and hydraulic fracturing (frac) the appropriate formation in the horizontal portion of the hole and running production tubing in the event that commercial production is established. Completion operations may also consist of running a frac string or tie back string of casing. This is a temporary casing string in the vertical section of the well tying into the production casing. If frac sleeves have been run, then generally the well would not be perforated. If no frac sleeves were run, then perforations would be made in the production casing. The frac sleeves and perforations allow for the stimulation or fracturing taking place.

Actuating the frac sleeves and perforating generally happen with the frac fleet on location. With the first set of perforations or frac sleeve open, the well bore is now in communication with the target formation, and hydraulic fracturing may begin. Water, proppant or sand, and a small amount of chemical additives, all referred to as a slurry, would be pumped down the wellbore, through perforations or sleeves in the casing, and into the target formation. The chemical additives are used to ensure quality of the fracture fluid is adequate to carry the sand or proppant into formation at pressure and temperature very different from surface conditions. Pumping pressures are monitored through the entire program and are increased to the point where fractures initiate in the target formation at the perforations into the formation. The slurry flows into the initiated fractures and helps to extend the fractures away from the well bore in the target formation. The proppant, or sand, props the created fractures open after the pressure drops, leaving easier pathways for reservoir fluids to flow back to the well, when the well is placed on production.

Upon completion of the fracturing operation, the well would be flowed back to the surface through temporary production equipment in an attempt to recover as much of the frac fluids as possible and to clean excess sand out of the lateral prior to setting production equipment on location and commencing production. All fluids returned during the flow-back procedure are captured in steel tanks situated on the well location, with these recaptured fluids ultimately disposed of in strict accordance with both BLM and WOGCC rules and regulations. Any fresh water remaining in the frac reservoir following the completion operations may be used for future completion activities on other wells within the project area with approval from the BLM and/or WOGCC as appropriate. The fresh-water pit used in completion operations would not remain open for more than six months following completion operations unless approved by the AO.

Several diagnostic techniques may be used to monitor hydraulic fracture generation. Down hole micro seismic monitoring has been used in the Powder River Basin, and elsewhere, to monitor hydraulic fracture generation and growth. Conventional

temperature and chemical tracer surveys and production logging have also been used to monitor the fracturing treatment.

Table 2.2 contains a representative sample showing the composition, in percent by volume, of a typical frac fluid. Approximately 98% of the fracturing fluid is comprised of water and sand. The sample is from a well posted on the public disclosure website www.fracfocus.org. The fracturing fluid injected into the target formation is confined by thousands of feet of rock layers from shallower potable water aquifers. The function of the fracturing fluid is to transmit energy to the formation to split the rock, and to transport the proppant, or sand. The fracturing fluid is determined based on compatibility with the formation minerals and fluid composition, and recoverability.

Fracturing Fluid = Base Fluid + Additives + Proppant

Table 2.2. Function of Additives Typically Present in Fracturing Fluid[a]

Materials Used	**Hydraulic Fracturing Use**
Guar gum	Gelling agent to thicken fluid
Potassium hydroxide Potassium formate Potassium metaborate	Cross linkers to super thicken fluid
Ammonium persulfate diammonium peroxidisulphate Sodium persulfate Chlorous acid or sodium chloride (salt)	Breakers used to reduce viscosity of the fluid after treatment to allow fluid to flow more easily out of the formation for recovery
Isopropanol	Surfactants reduce surface tension to aid in fluid recovery
Ethylene glycol Isopropanol Lauryl sulfate	Non-emulsifiers prevent treatment fluid and reservoir liquids from emulsifying
Sodium hydroxide, otherwise known as lye	Biocides kill bacteria to prevent it from destroying gelling agents before the treatment can be pumped
[a]For a more complete list of possible materials and their function, refer to http://fracfocus.org/chemical-use/what-chemicals-are-used	

Production Operations

Production equipment required on the individual well locations would typically include the following:

- a pumping unit at the well head for each individual well;
- a heater/treater for each individual well;

- a tank battery which would generally consist of four to eight 400-barrel steel tanks/well.
- a flare stack; and,
- meter runs for gas sales from each individual well bore if/where applicable (appendix B).

A gas lift system or electric submersible pump may be used instead of a rod pump jack. Any of these artificial lift methods used on non-flowing wells require power, which may come from a generator, or electric power service, if available. Production facilities are installed on the disturbed portion of each well pad, a minimum of 25 feet from the toe of the back slope, wherever practical.

All permanent above ground production facilities installed on the producing well location would be painted one of the standard environmental colors recommended by the Rocky Mountain Five-State Interagency Committee to be selected at the discretion of the BLM. A dike would be constructed completely around those production facilities designed to hold fluids (i.e., production tanks and/or heater/treater). Dikes would be constructed of compacted subsoil or some other impervious material, hold 110% of the capacity of the largest tank, and would be independent of the back cut. Load-out lines would be located outside the tank battery dike and would have a heavy screen-covered drip barrel installed under the outlet. A metal staircase would be placed over the dike to protect the dike as well as support the tanker truck flexible hose. Each operator develops and maintains site-specific SPCC plans for each production facility.

Oil produced from each well would be collected in tanks installed on the individual well locations and would be periodically trucked to a pre-existing oil terminal for sales. The frequency of trucking activities would depend solely on the amount of oil produced from each individual well. A typical production facility layout is presented as part of Appendix B.

Produced Water

Produced water and completion flowback water is separated from the oil and gas and stored in tanks. The water is trucked (if no pipeline is present) or piped to private or commercial underground injection wells, or commercial evaporation pond facilities. The state of Wyoming permits all underground injection wells and water disposal facilities.

Oil and Natural Gas Transportation

Oil separated from the water and gas from each well is stored in a tank and trucked to a pipeline gathering point or transported via a gathering pipeline directly from the well into a main oil pipeline.

Gas separated from the oil and water is transported via a gathering pipeline directly to a gas gathering point. The pit flare may be used to burn gas in the event some activity

resulted in the gas quality not meeting gas line specifications. Once the gas quality meets specifications, the gas would again go directly to sales.

All produced fluids are measured per onshore order specifications and state of Wyoming rules. That information is reported to the state of Wyoming and the federal government per regulatory reporting requirements.

Interim and Final Reclamation

All disturbed surfaces would be reclaimed as soon as possible after the initial disturbance. This reclamation consists primarily of backfilling the cuttings and frac water pits, leveling and contouring "non-working" disturbed areas, redistributing stockpiled topsoil over these disturbed areas, installing erosion control measures, and reseeding as recommended by the BLM and/or private surface owner. Solidification and subsequent reclamation of the cuttings pits occurs as soon as possible following well completion. The cuttings pits would be backfilled immediately upon completion of the solidification process.

Interim reclamation of the well location including reducing the cut and fill slopes, redistributing the stockpiled topsoil over the recontoured slopes, and reseeding disturbed areas would be accomplished within a maximum of two years following the termination of drilling and completion operations.

Topsoil would be stripped from the access road corridor as directed by the affected fee surface owner(s) or BLM before construction activities begin. The stockpiled topsoil would be redistributed on the "out slope" areas of the borrow ditch following completion of road construction activities. These borrow ditch areas would be reseeded as soon as practical thereafter with a seed mixture recommended by either the private surface owner or the BLM. In the event that commercial production is established from any/all of the proposed wells, the access roads would be graveled with a minimum of four inches of gravel as necessary or required by either the private surface owner or the BLM. The roadway would remain in place for the productive life of the well(s). This gravel would be obtained from commercial gravel suppliers in the area and would be identified when the APD is submitted.

Upon final abandonment of each well, all existing surface facilities would be removed from the well location, the well bore would be physically plugged with cement as directed by the BLM, and a dry hole marker would be set in accordance with existing regulations and direction contained in the approved APD. When plugging operations are complete, both the access road and remaining "work" areas of each abandoned well location would be scarified and recontoured, erosion control measures would be installed as necessary, and all recontoured (disturbed) areas would be reseeded as recommended by the BLM and/or private surface owner. However, there may be certain circumstances where the private surface owner may wish to retain specific access roads for future use at the time of final abandonment. All interim and final reclamation would be in accordance with the guidelines contained in the approved APD.

As a way to monitor and track approved versus actual disturbance and reclamation success, the BLM may require as built shapefiles from operators. Tracking and monitoring reports will be maintained for the project.

CHAPTER 3: THE AFFECTED ENVIRONMENT

Introduction

The East Converse project area encompasses approximately 196 square miles and 125,520 acres of mixed federal, state and fee (private) lands in eastern Converse and western Niobrara counties, Wyoming. Based on the electronic records obtained from the WOGCC (WOGCC 2012), approximately 158 oil and gas wells have either been drilled, are currently producing, or have been plugged and abandoned in the project area.

Existing oil and gas development within the project area prior to the 2007 RMP revision is depicted in table 3.1. The table also shows the well activity since the ROD/RMP was signed for the *Record of Decision and Approved Casper Resource Management Plan* in December 2007.

Table 3.1. Existing Oil and Gas Development Prior to and After Casper ROD/RMP Revision (December 2007)

Oil and Gas Well Status	Before ROD/RMP Revision	After ROD/RMP Revision[a]	Total Wells
OVERALL			
Plugged & Abandoned Wells	70	0	70
Operational Wells	81	7	88
Total Existing Wells	**151**	**7**	**158**
FEDERAL			
Plugged & Abandoned Wells	40	0	40
Operational Wells	33	6	39
Total Existing Wells	**73**	**6**	**79**
STATE			
Plugged & Abandoned Wells	6	0	6
Operational Wells	10	0	10
Total Existing Wells	**16**	**0**	**16**
FEE			
Plugged & Abandoned Wells	24	0	24
Operational Wells	38	1	39
Total Existing Wells	**62**	**1**	**63**
[a] Spud date as of February 15, 2012			

Transportation Systems

Trucks and other vehicles use an extensive network of highways, county roads, oil and gas field roads, and ranch roads to move people, equipment, and goods to facilitate exploration and subsequent transportation of produced oil to market. Wyoming Highway 59 runs north and south to the west of the project area. Two county roads

(Walker Creek and Manning) run generally southwest-northeast across the area. A third (20 Mile Creek) runs north-south in the southern portion of the area, providing the principal access to and through the area. Some of the roads in this transportation network are or would be authorized by rights-of-way.

Classifications

Coal classifications exist in the area. They were created to identify and reserve potential coal lands but no longer serve any purpose and are identified for termination in the Casper RMP.

Air Resources

This EA incorporates an analysis of the contributions of the proposed activities to greenhouse gas (GHG) emissions and a general discussion of potential impacts to climate. Air resources include climate, climate change, air quality, air quality-related values (AQRV) (including visibility and atmospheric deposition), noise, and smoke management. Therefore, NEPA requires the BLM to consider and analyze the potential effects of BLM and BLM-authorized activities on air resources as part of the planning and decision-making process.

The air quality of any region is controlled primarily by the magnitude and distribution of pollutant emissions and the regional climate. The transport of pollutants from specific source areas is affected by local topography. In the mountainous western United States, topography is particularly important in channeling pollutants along valleys, creating upslope and downslope circulations that may entrain airborne pollutants, and block the flow of pollutants toward certain areas. In general, local effects are superimposed on the general weather regime and are most important when the large-scale wind flow is weak.

New information about GHGs and their effects on national and global climate conditions has emerged. On-going scientific research has identified the potential impacts of GHG emissions such as carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), water vapor; and several trace gases on global climate. Through complex interactions on a global scale, GHG emissions cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space. Although GHG levels have varied for millennia (along with corresponding variations in climatic conditions), industrialization and burning fossil carbon sources have caused GHG concentrations to increase measurably and may contribute to overall climatic changes.

Air Quality and Visibility

The EPA established National Ambient Air Quality Standards (NAAQS) for criteria pollutants. Criteria pollutants include carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), and lead (Pb).

The Wyoming Department of Environmental Quality (WDEQ) is the agency that administers air quality for the state. Wyoming Ambient Air Quality Standards (WAAQS) and National Ambient Air Quality Standards (NAAQS) identify maximum limits for concentrations of criteria air pollutants at all locations accessible by the public. The WAAQS and NAAQS are legally enforceable standards. Concentrations above the WAAQS and NAAQS represent a risk to human health. By law, public safeguards are required to be implemented. State standards must be at least as protective of human health as federal standards and may be more restrictive than federal standards, as allowed by the Clean Air Act of 1977, as amended (CAA).

For the most part, ~~T~~the counties that lie within the jurisdictional boundaries of the BLM High Plains District Office (DO) (Natrona, Converse, Platte, Goshen, Niobrara, Weston, Crook, Campbell, Sheridan, and Johnson) are classified as in attainment ~~of~~ for all state and national ambient air quality standards as defined in the CAA. The one exception is the City of Sheridan, which was designated as nonattainment for PM10 in 1991 (56 FR 11101). All sites operated by the Wyoming Department of Environmental Quality, Air Quality Division, in the High Plains DO, including the City of Sheridan, are currently in compliance with the NAAQS and WAAQS. ~~Modeling conducted to date by the WDEQ does not indicate that air quality is likely to exceed any limits specified by the CAA in the near future.~~

Various state and federal agencies monitor air pollutant concentrations and visibility throughout Wyoming. Table 3.2 lists the available air quality monitoring sites within the High Plains DO and relevant sites nearby. The WDEQ operates PM_{10} monitors as part of the state and local monitoring site (SLAMS) network. Other sites include interagency monitoring of protected visual environments (IMPROVE) network monitors and BLM-administered sites that are part of the Wyoming air resource monitoring system (WARMS). Atmospheric deposition (wet) measurements of ammonium, sulfate, and various metals are taken at the Sinks Canyon, South Pass, and Yellowstone Park sites, which the BLM operates as part of the national acid deposition program (NADP).

Table 3.2. Air Quality-Monitoring Sites within the High Plains DO

County	Site Name	Type of Monitor Type	Parameter	Operating Schedule	Location	
					Longitude	Latitude
Campbell	Thunder Basin	SPM	O3, NOx & Met	Hourly	-105.3000	44.6720
	South Campbell County	SPM	O3, NOx, PM10 & Met	1/3 (PM10) & hourly (NOx & O3)	-105.5000	44.1470
	Belle Ayr Mine	SPM	NOx & PM2.5	1/3 (PM2.5) & hourly (NOx)	-105.3000	44.0990
	Wright	SPM	PM10	1/6	-105.5000	43.7580
	Gillette	SLAMS	PM10	1/6	-105.5000	44.2880
	Black Thunder Mine	SPM	PM2.5	1/3	-105.2000	43.6770
	Buckskin Mine	SPM	PM2.5	1/3	-105.6000	44.4720
	South Coal	WARMS	PM2.5 & Meteorology		-105.8378	44.9411
	Thunder Basin	IMPROVE	PM2.5, Nitrate, Ammonium, Nitric Acid, Sulfate, Sulfur Dioxide & Meteorology	1/3	-105.2874	44.6634
Johnson	Buffalo	WARMS	PM2.5, Nitrate, Ammonium, Nitric Acid, Sulfate, Sulfur Dioxide & Meteorology	1/3 (PM2.5) & 1/7 (others)	-106.0189	44.1442
	Juniper	WARMS	PM2.5 & Meteorology	1/3 (PM2.5)	-106.2289	44.2103
	Cloud Peak	IMPROVE	PM2.5, Nitrate, Ammonium, Nitric Acid, Sulfate, Sulfur Dioxide & Meteorology	1/3	-106.9565	44.3335
Sheridan	Sheridan - Highland Park	SLAMS	PM10 & PM2.5	1/3 (PM10); 1/3 & 1/6 (PM2.5)	-107.0000	44.8060
	Sheridan – Police Station	SLAMS	PM10 & PM2.5	1/1 (PM10) & 1/3 & 1/6 (PM2.5)	-107.0000	44.8330
	~~Arvada~~	~~SPM~~	~~PM10~~		~~-106.1000~~	~~44.6540~~
	Sheridan	WARMS	PM2.5, Nitrate, Ammonium, Nitric Acid, Sulfate & Sulfur Dioxide	1/3 (PM2.5) & 1/7 (others)	-106.8472	44.9336
Converse	Antelope Mine	SPM	~~NOx &~~ PM2.5	1/3 (PM2.5) & hourly (NOx)	-105.4000	43.4270
Natrona	Casper	SLAMS	PM10 & PM2.5	1/3	-106.3256	42.8516
Weston	Newcastle	WARMS	PM2.5, Nitrate, Ammonium, Nitric Acid, Sulfate, Sulfur Dioxide & Meteorology	1/3 (PM2.5) & 1/7 (others)	-104.1919	43.8731
	Newcastle	NADP	Wet deposition of ammonium, sulfate, metals	Weekly	-104.1917	43.873
Table updated by BLM WYSO staff, to reflect conditions as of 2011.						

BLM assessed recent air quality conditions within the High Plains DO boundary by examining data collected by monitors in the area, supplemented by various monitors in neighboring planning areas, as summarized in table 3.3. The examination of these data indicates that the current air quality for criteria pollutants in the High Plains DO is good and in compliance with applicable NAAQS and WAAQS. Based on measurements in the area, visibility in the High Plains DO is excellent.

Table 3.3. Air Quality Conditions

Pollutant	Averaging time	NAAQS (WAAQS if different)	Representative Concentrations	Data Source
Carbon Monoxide (CO)	1 hour	35 ppm	**1.6 ppm**	**Murphy Ridge** - 2007 Data source: EPA's Air Quality System (AQS) Quick Look Report (AQS ID: 56-041-0101)
	8 hour	9 ppm	**1.5 ppm**	
Nitrogen Dioxide (NO_2)	1 hour	100 ppb	**11 ppb**	3 year average of the 98th percentile for **Thunder Basin National Grasslands**, 2009-2011. Data Source EPA's AQS Quicklook Report (AQS ID 56-005-0123)
	Annual	53 ppb	**2 ppb**	Annual arithmetic mean value for **Thunder Basin National Grasslands**, 2011. Data source: EPA's Air Quality System (AQS) Quick Look Report (AQS ID: 56-0035-0123)
Ozone	8 hour	0.075 ppm	**0.061 ppm**	3-year average of the fourth highest daily maximum 8-hour ozone concentration at **Thunder Basin National Grasslands**, 2009-2011. Data source: EPA's Air Quality System (AQS) Quick Look Report (AQS ID: 56-0035-0123)
PM_{10}	24 hour	150 µg/m3	**41 µg/m^3**	2011 max PM10 concentration at **South Campbell County** Air Quality Monitoring Station. Data Source: EPA's Air Quality System (AQS) Quick Look Report (AQS ID: 56-005-0456)
	Annual	(50 µg/m3)	**11 µg/m^3**	3-year average of the weighted annual mean PM10 concentration at **Campbell County** Air Quality Monitoring Station. Data Source: EPA's Air Quality System (AQS) Quick Look Report (AQS ID: 56-005-0456). Years 2009-2011
$PM_{2.5}$	24 Hour	35 µg/m3	**8 µg/m^3**	3-year average of the 98th percentile of the 24-hour PM2.5 concentration at **Antelope** Air Quality Monitoring Station. Data Source: EPA's Air Quality System (AQS) Quick Look Report (AQS ID: 56-009-0189). Years 2009-2011. Note: During this period the monitoring method was changed, one or more years of incomplete data are used in this calculation.
	Annual	15.0 µg/m3	**3.3 µg/m^3**	3-year average of the weighted annual mean PM2.5 concentration at **Antelope** Air Quality Monitoring Station. Data Source: EPA's Air Quality System (AQS) Quick Look Report (AQS ID: 56-009-0819). Years 2009-2011. Note: During this period the monitoring method was changed, one or more years of incomplete data are used in this calculation.
Sulfur Dioxide (SO_2)	1 hour	75 ppb	**4 ppb**	3 year average of the 99th percentile at **Murphy Ridge** Monitoring Station 2007-2009. Data source: EPA's Air Quality System (AQS) Quick Look Report (AQS ID: 56-041-0101)
	3 hour	(0.5 ppm)	**0.0049 ppm**	Annual Summary Report for **Murphy Ridge**: January 1, 2009 – December 31, 2009.
	24 hour	(0.10 ppm)	**0.0021 ppm**	Annual Summary Report for **Murphy Ridge**: January 1, 2009 – December 31, 2009.
	Annual	(0.02 ppm)	**0.00029 ppm**	Annual Summary Report for **Murphy Ridge**: January 1, 2009 – December 31, 2009.

There are several national parks, national forests, recreation areas, and wilderness areas within and surrounding the High Plains DO. Table 3.4 lists areas designated as class I or class II. National parks, national monuments, and some state-designated wilderness areas are class I. The Clean Air Act "declares as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class I federal areas . . . from manmade air pollution" (42 USC § 7491(a)(1).25). Under BLM Manual Section 8560.36, BLM lands, including wilderness areas not designated as class I, are managed as class II, which provides

that moderate deterioration of air quality associated with industrial and population growth may occur.

The BLM works cooperatively with several other federal agencies to measure visibility with the IMPROVE network. Data collected at the Thunder Basin National Grasslands and Cloud Peak Wilderness IMPROVE monitoring sites have been used indirectly to measure visibility in the High Plains DO. Figure 1 presents visibility data for the Thunder Basin IMPROVE site for the period preceding 2010 and figure 2 presents visibility data for the Cloud Peak IMPROVE site for the period preceding 2010. Data for the two sites are consistent and show very good to excellent visibility ranges, even for the haziest days (20%). Although there are not enough data to discern trends at the Thunder Basin site, the five-year record at the Cloud Peak site does show a very slight degradation of visibility over this period.

Table 3.4 National Parks, Wilderness Areas, and National Monuments

Area Name	Distance from High Plains District (miles)	Direction from the High Plains District	Clean Air Act Status of the Area
Badlands National Park	>100	East	Class I
Bridger Wilderness Area	90	West	Class I
Cloud Peak Wilderness Area	within	---	Class II
Devils Tower National Monument	within	---	Class II
Fitzpatrick Wilderness Area	100	West	Class I
Grand Teton National Park	>100	West	Class I
Jewel Cave National Monument	<20	East	Class II
North Absaroka Wilderness Area	>100	Northwest	Class I
Teton Wilderness Area	>100	Northwest	Class I
Washakie Wilderness Area	>100	Northwest	Class I
Wind Cave National Park	<50	East	Class I
Yellowstone National Park	>100	Northwest	Class I
Source: NPS 2006			

In addition to visibility measurements within the High Plains DO, figure 3 displays visibility estimates for the Badlands National Park site, located east of the High Plains DO, preceding 2010. This figure shows the annual average visual range estimates and the estimates for the 20% clearest days and 20% haziest days. The visibility estimates for the Badlands site are lower when compared to the Thunder Basin and Cloud Peak sites, but indicate no real trend in support vector regression (SVR) during this period.

Figure 1. Annual Visibility (SVR) for the Thunder Basin IMPROVE Site in 2010

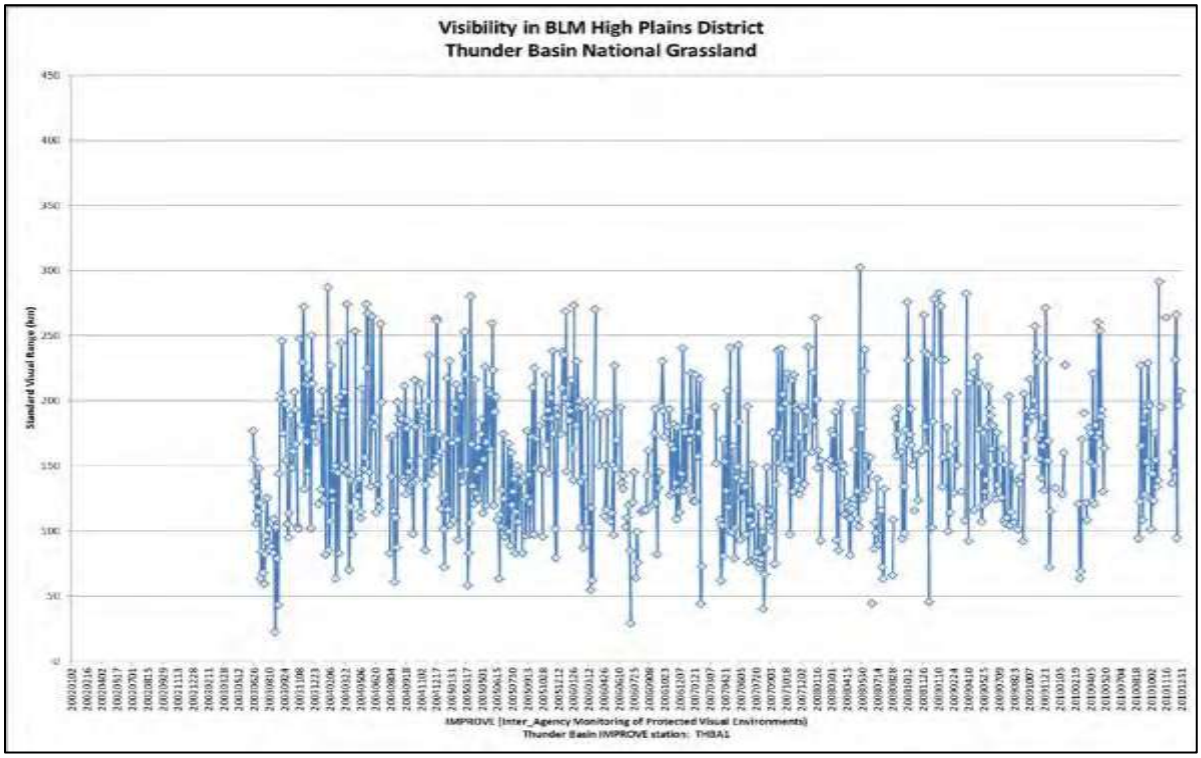


Figure 2. Annual Visibility (SVR) for the Cloud Peak IMPROVE Site in 2010

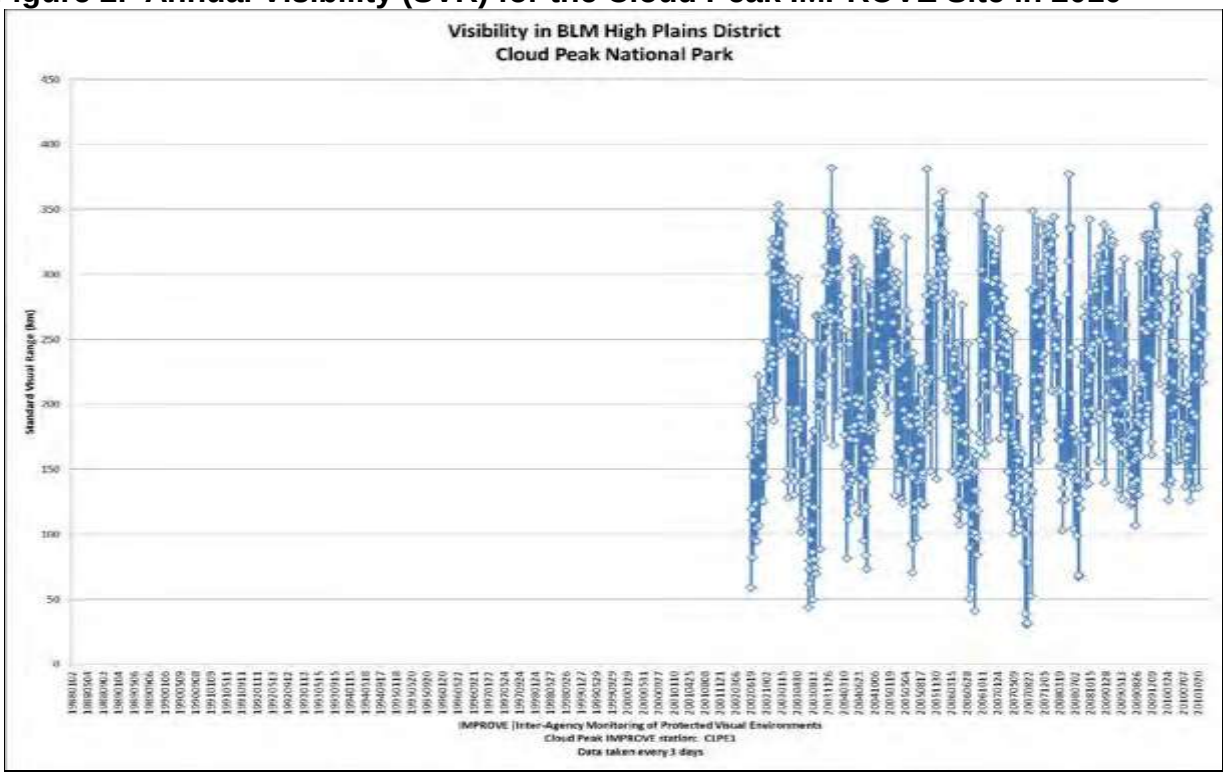
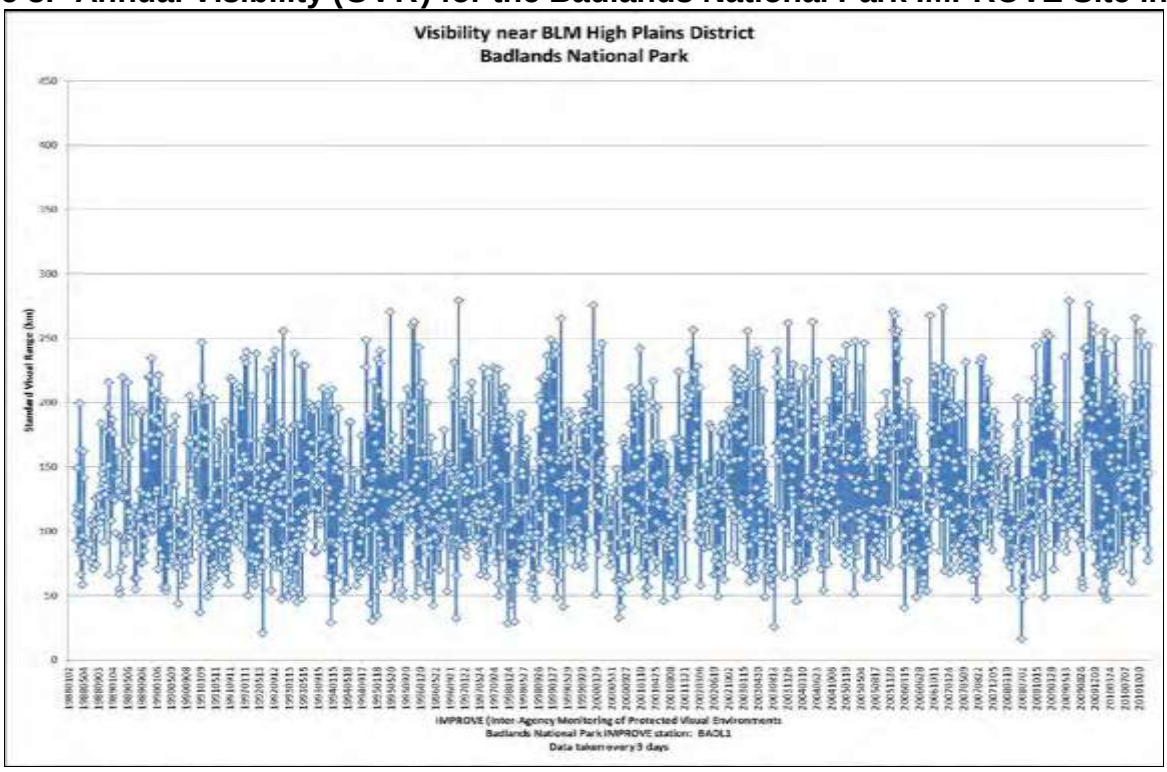


Figure 3. Annual Visibility (SVR) for the Badlands National Park IMPROVE Site in 2010



Greenhouse Gas Emissions

Greenhouse gases included in the US greenhouse gas inventory are CO_2, CH_4, N_2O, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). CO_2 and CH_4 are typically emitted from combustion activities or are directly emitted into the atmosphere.

Currently, the WDEQ, Air Quality Division (WDEQ/AQD) does not regulate GHG emissions, although they are controlled indirectly by various other regulations.

Some greenhouse gases (carbon dioxide) occur naturally and are released to the atmosphere through natural processes and human activities. Other greenhouse gases (e.g., fluorinated gases) are created and released solely through human activities. The primary greenhouse gases that enter the atmosphere because of anthropogenic activities include CO_2, CH_4, N_2O, and fluorinated gases such as hydrofluorocarbons, per fluorocarbons, and sulfur hexafluoride. These synthetic gases are released from a variety of industrial processes.

Several activities occur within the High Plains DO that may generate greenhouse gas emissions including oil, gas, and coal development; large fires; livestock grazing; and recreation using combustion engines that can generate CO_2 and methane. Oil and gas development activities can generate CO_2 and CH_4. CO_2 emissions result from the use of combustion engines, while methane can be released during processing.

Wildland fires are also a source of other GHG emissions, while livestock grazing is a source of methane.

Heritage and Visual Resources

Cultural Resources

Cultural resources are fragile, nonrenewable evidence of human history and heritage on the landscape. Over 10,000 years of human occupation has been documented throughout the region. Generally, the occupation is divided into prehistoric and historic periods. The prehistoric period encompasses the indigenous Native American occupation of the region and represents most of the time span. The historic period generally begins at the time of European and Euro-American contact with the indigenous Native American populations. Both the prehistoric and historic occupations periods are further divided into other periods based on either technology changes or broad based cultural patterns. These periods will not be discussed further as they are well documented in current academic and popular literature.
The project area is located in eastern Converse and western Niobrara counties, Wyoming and covers approximately 196 contiguous square miles (125,521 acres). A literature search conducted for this EA using local BLM records and the Wyoming State Historic Preservation Office (SHPO). A summary of the cultural resources documented in the project area follows.

Cultural resource documentation has occurred throughout the study area for over 40 years. To date, professional cultural resource specialists have conducted and documented 147 individual class III surveys. Because of these surveys, 47 specific sites located throughout the study area have been documented. Over 60% of these surveys meet current documentation standards.

Of the 47 documented sites, 28 are prehistoric, 18 are historic, 1 contains prehistoric and historic components. There are 6 sites listed on or eligible for the National Register of Historic Places (NRHP); 20 sites are not eligible for the NRHP. There are 21 sites where eligibility for the NRHP is unknown. In summary, the sites represent most periods and span a wide range of site types.

Paleontology

The surface geology of the study area has been classified and scored by the potential fossil yield classification (PFYC) system which indicates the relative potential for fossil materials to be present in given locations. The PFYC is a relative value that rates the potential for an entire formation and is not a true indicator of the presence or absence of fossils in any given location. For example, Morrison Shale has high concentrations of paleontological materials in some areas and is devoid of them elsewhere. The numeric score is between one and five, with five being the most sensitive. Paleontology localities are common in formations with a PFYC rating of five.

The bedrock formation in the study area has a PFYC rating of 3/3a or a moderate potential for the presence of fossil materials. A small portion in the northeast corner of the study area has a PFYC rating of two, which is a lower potential for the presence of fossil materials. Currently, there are no recorded fossil localities within the project area.

Visual Resources

The purpose of visual resource management (VRM) is to manage the quality of the visual environment and reduce the visual impact of development activities while maintaining the viability of all resource programs. A visual resource inventory was completed in 2003 to assist in the development of the Casper Field Office RMP. Based on the inventory, all lands within the field office were classified into one of four classes: class I, class II, class III, and class IV. Each class has a set of objectives as defined in BLM Visual Resource Handbook 8410-1 and described below:

> Class I – to preserve the existing character of the landscape. This provides for the natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.
>
> Class II –to retain the existing character of the landscape. The level of change should be low. Management activities may be seen, but should not attract the attention of the casual observer. The basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape should be repeated.
>
> Class III – to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
>
> Class IV – to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of the viewer attention. However, every attempt should be made to minimize the impacts of these activities through careful location, minimal disturbance, and repeating basic elements.

The East Converse project area is entirely within VRM class IV.

Range Management

Range management is a discipline and an art that skillfully applies an organized body of knowledge accumulated by range science and practical experience for two purposes: (1) protection, improvement, and continued welfare of the basic resources, which in

many situations include soils, vegetation, endangered plants and animals, wilderness, water, and historical sites; and (2) optimum production of goods and services in combinations needed by society (Heady and Child).

Rangeland supports different vegetation types including shrublands such as deserts and chaparral, grasslands, steppes, woodlands, temporarily treeless areas in forests, and wherever dry, sandy, rocky, saline, or wet soils and steep topography preclude commercial farm and timber from growing (Heady and Child)

Grazing Allotments and Existing Range Improvements

There are nine grazing allotments within the project area. The table below includes all of the acres and animal unit months (AUMs) within each allotment, including those that go outside of the project area. As shown in table 3.5 there are approximately 13,087 acres of BLM-administered public lands (surface estate) within the allotments that intersect the project area. Not all of the BLM acres stated are within the project boundary, however they are important to mention, as these acres are used to determine the average acreage per AUM.

Table 3.5. Grazing Allotments within the Project Area

Allotment Name	Allotment Number	Acreage	AUMs on BLM Land
Colter Draw	00235	2,160	163
Cottonwood Creek 2	10418	1,160	121
Walker Creek	00371	4,613	744
Twenty Mile Creek	00341	3,074	663
Twenty Mile Creek 2	00384	640	93
East FK Twenty Mile	00242	40	5
Twenty Mile Creek 3	00484	320	42
Kaye North	13661	440	66
Kaye South	14534	640	97
Total		**13,087**	**1,994**

These allotments have range improvements such as fencing, ponds, wells, livestock troughs, storages, and pipelines. Season of livestock use varies by allotment, but year round use is common among the allotments.

Soils and Ecological Sites

The four dominant ecological sites within the project area are Shallow Clayey 10-14 inch precipitation zone Northern Plains, Shallow Loamy 10-14 inch precipitation zone Northern Plains, Loamy 10-14 inch precipitation zone Northern Plains and Shallow Sandy 10-14 inch precipitation zone Northern Plains and are displayed on map 3. The remaining ecological sites consist of ponderosa pine woodlands, saline upland, lowlands, clayey, and sandy areas. Typical vegetation found within these sites are green needlegrass, western wheatgrass, bluebunch wheatgrass, winterfat, big

sagebrush, prairie junegrass, needle and thread, blue grama, little bluestem, thickspike wheatgrass, threadleaf sedge, prairie sandreed, Indian ricegrass, and sand bluestem. Other vegetation found within the remaining ecological sites are Sandberg bluegrass, skyline bluegrass, slender wheatgrass, snowberry, cottonwood, silver sagebrush, greasewood, Gardner's saltbush, inland saltgrass, and alkali sacaton.

The soils of the Shallow Clayey ecological site are shallow (less than 20 inches to bedrock) well-drained soils formed in alluvium or residuum. These soils have moderate to slow permeability and may occur on all slopes. The bedrock is clay shale, which is virtually impenetrable to plant roots. The soil textures included in this site are silty clay, clay, and the finer portions of sandy clay loam, clay loam, or silty clay loam. Thin ineffectual layers of other soil textures are disregarded. Layers of the soil most influential to the plant community vary from three to six inches thick.

The soils of the Shallow Loamy ecological site are shallow (less than 20 inches to bedrock) well-drained soils formed in alluvium over residuum or residuum. These soils have moderate permeability and may occur on all slopes. The bedrock may be any kind which is virtually impenetrable to plant roots, except igneous. The surface soil would have one or more of the following textures: very fine sandy loam, loam, silt loam, sandy clay loam, silty clay loam, and clay loam. Thin ineffectual layers of other textures are disregarded. Layers of the soil most influential to the plant community vary from three to six inches thick.

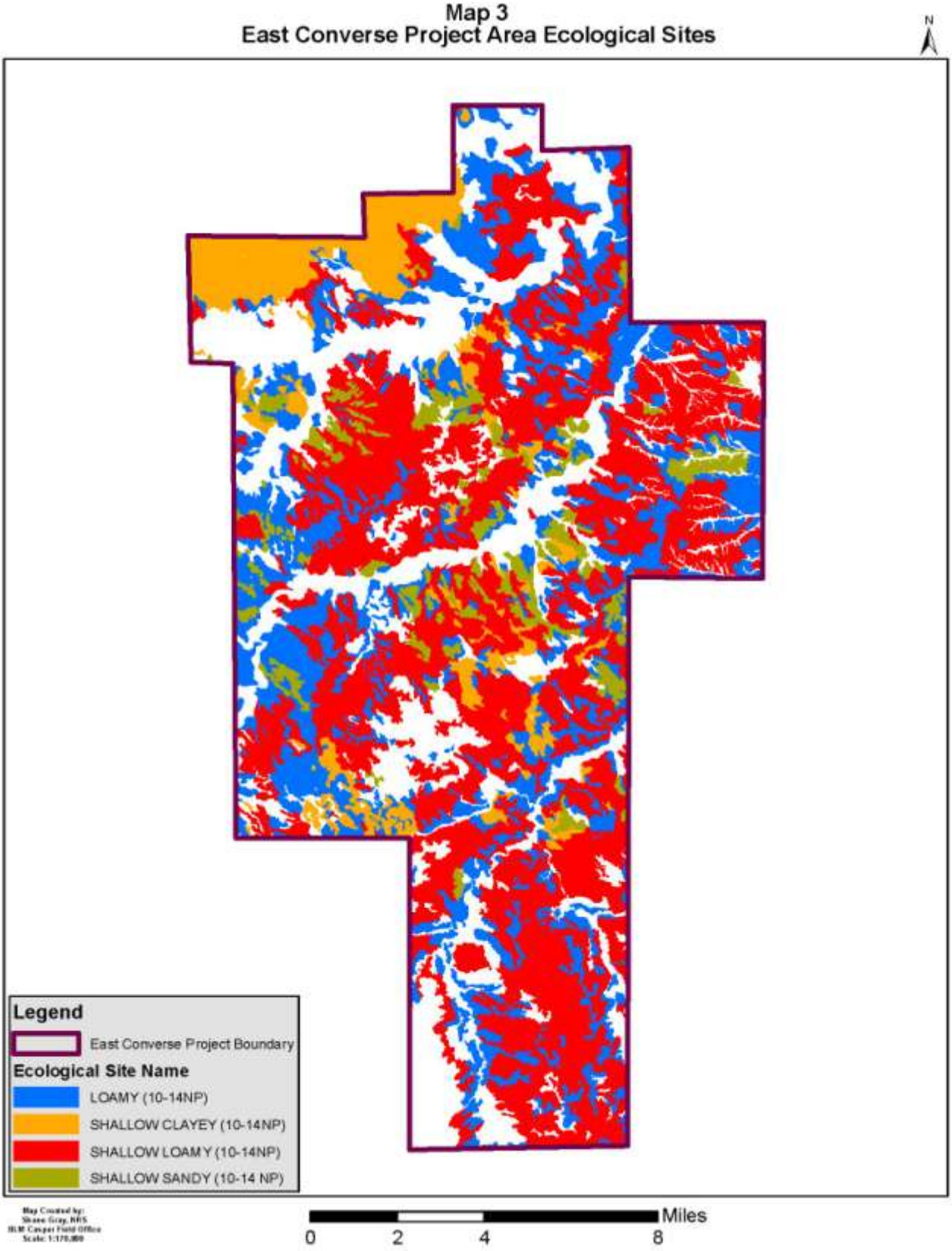
The soils of the Loamy ecological site are deep to moderately deep (greater than 20 inches to bedrock), well drained and moderately permeable. Layers of the soil most influential to the plant community varies from three to six inches thick. These layers consist of the A horizon with very fine sandy loam, loam, or silt loam texture and may also include the upper few inches of the B horizon with sandy clay loam, silty clay loam or clay loam texture.

The soils of the Shallow Sandy ecological site are shallow (less than 20 inches to bedrock) well-drained soils formed in eolian deposits or alluvium over residuum or residuum. These soils have moderately to rapid permeability and may occur on all slopes. The bedrock may be of any kind except igneous or volcanic and is virtually impenetrable to plant roots. The surface soil would be one or more of the following textures: fine sandy loam, sandy loam, loamy fine sand, loamy sand, or sand. Thin ineffectual layers of other soil textures are disregarded. Layers of the soil most influential to the plant community vary from three to six inches thick.

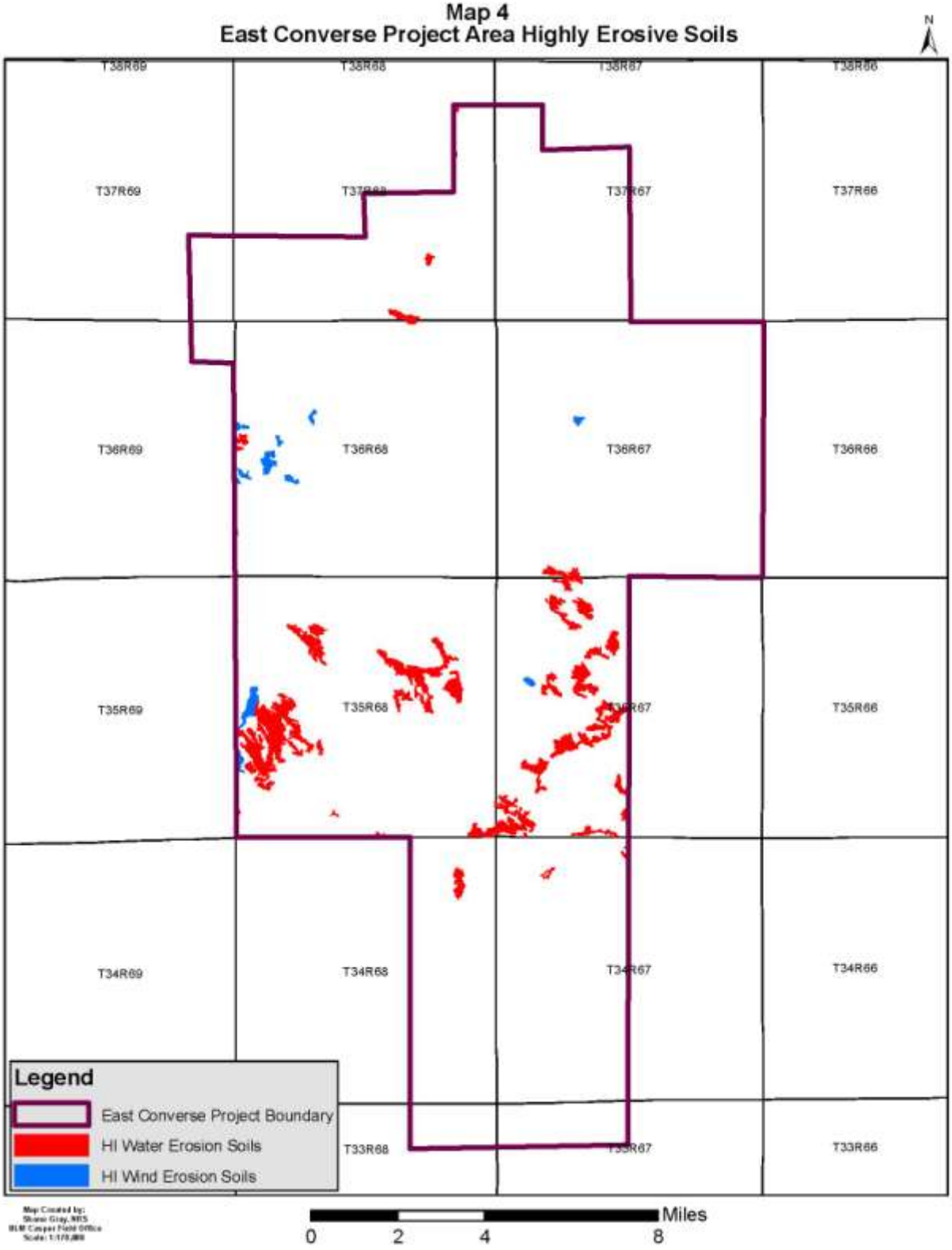
There are no areas within the project area boundary that have 26% and greater slopes.

Approximately 360 acres are classified as having the potential for high wind erosion (less than 1%) and 3,337 acres (2.7%) are classified as having the potential for high water erosion within the project area. Map 4 shows the locations of these highly erosive soils within the project area.

Map 3
East Converse Project Area Ecological Sites



Map 4
East Converse Project Area Highly Erosive Soils



Vegetation

The two primary vegetation types within the project area are mixed grass prairie and Wyoming big sagebrush. Common vegetation found in these plant communities include Wyoming big sagebrush, silver sagebrush, winterfat, rabbitbrush, green needle grass, needle-and-threadgrass, western wheatgrass, bluebunch wheatgrass, prairie Junegrass, Sandberg bluegrass, bluegrama, little bluestem, asters, paintbrushes, clovers, biscuitroot, western yarrow, fringed sagewort, Hoods phlox, buckwheat's, and numerous other grasses and forbs.

Most plant growth occurs between May and June. According to the ecological site description, as this site deteriorates species such as blue grama and big sagebrush increase and cool-season grasses such as needlegrass, needleandthread, rhizomatous wheatgrasses will decrease in frequency and production.

Annuals bromes will commonly increase with improper management as well. Vegetation types such as irrigated crop, greasewood fans and flats, graminoid/forb dominated riparian, forest dominated riparian, and basin-exposed rock/soil~~, and mining operations type~~ are present within the project area.

A complete description of each ecological sites' plant community commonly present, particularity the most common (Loamy, Clayey, Shallow Loamy, and Sandy (10-14" Northern Plains) can be found on Natural Resource Conservation Service's (NRCS) National Soil Survey Handbook online at this web address http://soils.usda.gov/technical/handbook/

Invasive, Non-Native Plant Species (INPS)

Invasive plants are defined as "non-native plants whose introduction does or is likely to cause economic or environmental harm or harm to human health," based on the definition provided in Executive Order 13112[1]. Invasive plants are compromising the ability to manage BLM lands for a healthy native ecosystem.

The CFO and the Converse County Weed and Pest District have a memorandum of understanding (MOU) that provides authorization to manage invasive plants throughout Converse County using an integrated pest management approach[2]. Noxious weeds and their known locations throughout the CFO administrative area are identified in table 3.6 (this list is not all-inclusive).

1 EXECUTIVE ORDER 1311 INVASIVE SPECIES (1999) - directs federal agencies to prevent the introduction of invasive species and provide for their control, and to minimize the economic, ecological, and human health impacts that invasive species cause.
2 INTEGRATED PEST MANAGEMENT - a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks (DOI Departmental Manual 517)

Invasive, non-native plant species such as cheatgrass, musk thistle, Canada thistle, field bindweed, Russian knapweed, spotted knapweed, diffuse knapweed, leafy spurge, hoary cress, halogeton, perennial pepperweed, and dalmatian toadflax may all occur within the boundary of the project area.

Table 3.6. Invasive Non-Native Species (noxious weeds)

Species	Location
Leafy spurge *Euphorbia esula L.*	Confined to the Rattlesnake Range and upper Hat Six valley of Natrona County with one isolated patch in the Pine Ridge area of Midwest (Little Bull Cedar Draw).
Spotted knapweed *Centaurea maculosa* Lam.	Mainly confined to the west side of Casper except for one location adjacent to the north side of Yellowstone Highway and Interstate 25 (I-25).
Diffuse knapweed *Centaurea diffusa* Lam.	The southern Bighorn Mountains and associated access roads of Natrona County.
Russian knapweed *Centaurea repens* L.	Riparian areas throughout Natrona County. Bates Creek and South Fork of the Powder River watersheds are the main problem areas.
Musk thistle *Carduus nutans* L.	Muddy Creek watershed, especially upper reaches in Beaver Creek, and Clear Fork Muddy Creek.
Scotch thistle *Onopordum acanthium* L.	South Fork of the Powder River watershed including I-25 near Midwest; feeder tributaries to Salt Creek and Midwest Oil Field.
Canada thistle *Cirsium arvense* L.	Ubiquitous locations throughout the county; namely riparian areas, sub-irrigated meadows, and forest clearings.
Houndstongue *Cynoglossum officinale* L.	Virtually all drainages flowing off south face of Casper Mountain. Isolated patches along North Platte River corridor.
Common burdock *Arctium minus* (Hill) Bernh.	North Platte River corridor.
Field bindweed *Convolvulus arvensis* L.	Throughout Natrona County on roadside ditches and pasturelands.
Perennial pepperweed *Lepidium latifolium* L.	Located in areas of alkaline soils, near riparian areas throughout the area administered by the CFO.
Dalmatian toadflax *Linaria dalmatica* (L.) Mill.	Crossroads Park, Claude and Squaw Creek drainages, Upper Garden Creek, and isolated patches above Clear Fork of Muddy Creek Canyon,
Whitetop *Cardaria draba* and *Cardaria pubescens* (L.) Desv.	Found throughout Natrona County.
Salt cedar *Tamaxix* ssp.	South Fork of Powder River and tributaries; Cloud Creek.
Russian olive *Elaeagnus angustifolia* L.	Platte River drainage in Natrona, Converse, and Goshen counties.

Water Resources

The boundary of the proposed activities lies within the Lightning Creek HUC 8 (10120105) watershed. Creeks within the project area are Box Creek, Dry Creek, East Fork Twentymile Creek, Harney Creek, Lightning Creek, Piney Creek, Twentymile Creek, Walker Creek, and West Harney Creek. Lightning Creek flows into Lance Creek, which eventually flows into the Cheyenne River. According to the WDEQ 2010 Integrated 305(b) and 303(d) report land uses in the Lightning Creek Sub-basin are chiefly grazing, with some oil and gas development. WDEQ uses a reach of Lightning Creek as a reference stream for the plains. Lightning Creek is a class 3B stream; that is, waters that have designated uses, such as other aquatic life, recreation, wildlife, agricultural, industry, and scenic values.

Groundwater

A review of the Wyoming State Engineer's office (WSEO) electronic records revealed that approximately 173 permitted water wells are within 1 mile of the project area. The wells range in depth from 0 to 900 feet with the median being 210 feet. One well, KTU-WSW #1, is 4,200-feet deep and is permitted to produce 105 gallons per minute for industrial groundwater use. Static water on these wells range from flowing to 490 feet below land surface (BLS), with the median being 35 feet BLS. The water bearing zones of these wells range from 10 to 723 feet BLS with the KTU-WSW #1 water-bearing zone being between 1,459 and 3,946 feet BLS.

The wells are used for either domestic or livestock watering purposes as follows:

- 144 wells permitted solely for livestock watering purposes;
- 3 wells permitted solely for domestic water use; and,
- 22 wells permitted for both domestic and livestock watering purposes.

In addition to the water wells used for domestic or livestock watering purposes within the analysis area, three more wells have been permitted through the WSEO for industrial and miscellaneous purposes.

The six major aquifers within the planning area from oldest to youngest are:

- Madison Aquifer System
- Dakota Aquifer System
- Fox Hills/Lance Aquifer System
- Fort Union/Wasatch Aquifer System
- Tertiary Aquifer
- Quaternary Aquifer System

Additional information on the groundwater resources of the project area can be found in the Northeast Wyoming River Basins Plan, Available Groundwater Determination (Wyoming Water Development Commission).

Surface Water and Wetlands

"Land uses in the Lightning Creek watershed are chiefly agricultural, with some oil and gas development. Nearly all reach miles in this watershed are non-perennial. Naturally occurring conditions (infrequent short duration intense rainfall, highly erodible geological parent materials) result in: occasional high turbidity stream flow primarily during snowmelt and after rainfall, intermittent standing water, and eventual sediment deposition" (Northeast Wyoming River Basins Water Plan Technical Memoranda).

No known springs exist within the project area. Table 3.7 lists wetlands and their respective acreage located within the project area. The list is from the National Wetlands Inventory GIS layer from the Fish and Wildlife Service (FWS 2009). The GIS layer was created using remote sensing data. There is a margin of error inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis. These wetlands may include man-made reservoirs.

Table 3.7. Wetlands in the Project Area

Wetland Type	Acres
Freshwater Emergent Wetland	193.2
Freshwater Forested/Shrub Wetland	5.6
Freshwater Pond	136.3
Other	35.1
Riverine	6.8

A review of the WSEO electronic records revealed that there are approximately 182 permitted water rights other than water wells within 1mile of the project area.

- 146 permitted reservoirs for livestock only;
- 2 permitted reservoirs for irrigation and livestock;
- 2 permitted reservoirs for fish propagation, recreation, and livestock;
- 3 permitted reservoirs for domestic use and irrigation;
- 1 permitted spring for domestic and livestock use;
- 7 permitted ditches for domestic and irrigation;
- 20 permitted ditches for irrigation; and,
- 1 permitted ditch for irrigation and livestock use.

Wildlife, Special Status Species, and Threatened and Endangered Species

Big Game Species

The pronghorn antelope *(Antilocapra americana)*, mule deer *(Odocoileus hemionus)*, white-tailed deer (*Odocoileus virginianus),* and elk (*Cervus elaphus*) are four big game species inhabiting the project area. Antelope habitat within the project area is classified into two different range types: winter yearlong (24,619 acres); and yearlong (100,902 acres. Mule deer habitat is classified into two range types: yearlong (52,741 acres) and winter yearlong (72,780 acres). White-tailed deer habitat in the project area is classified as yearlong (11,530 acres). The remainder of the project area (113,991 acres) is categorized as no habitat ("out") for white-tailed deer. The entire project area is classified as "undetermined" for elk habitat. It has not been determined as to how the elk use this area, though there is potential habitat. There is no crucial winter range for antelope, deer, or elk located within the project area (WGFD 2010). Table 3.8 contains a description of big game range types.

Table 3.8. Big Game Winter Range Types

Spring/Summer/Fall	A population or portion of a population of animals use the documented habitats within this range from the end of the previous winter to the onset of persistent winter conditions (variable, but commonly this period is between May 1 and November 30).
Winter Yearlong	A population or portion of a population of animals makes general use of the documented suitable habitat within this range on a year-round basis. During the winter (between December 1 and April 30), there is a significant influx of additional animals into the area from other seasonal ranges.
Yearlong	A population or portion of a population of animals makes general use of the suitable documented habitat within the range on a year-round basis. Occasionally, under severe conditions (extremely severe winters or drought) animals may leave the area.
No Habitat	These areas have no documented use by the species in question and are not a part of any herd unit for that species.
Out	These areas, while part of a herd unit, do not contain enough animals to be important habitat, or the habitats are of limited importance to the species.

Raptors

Raptors include eagles, hawks, owls, falcons, and vultures. Ten species of diurnal raptors and five species of owls could potentially occur within the project area. Nine of the 10 raptor species breed in Wyoming; the remaining specie—the rough-legged hawk—is a winter resident. Four of the owl species are year-round residents in the state, while the snowy owl is a winter resident only. Raptors use all vegetative types for foraging activities. Potential nesting habitat that exists throughout the project area includes rocky outcroppings, cliffs, trees along riparian corridors, and ridge tops.

A comprehensive inventory of raptor nesting activity in or adjacent to those lands included the project area has not been done. Individual inventories were conducted on a case-by-case basis in response to both past and present activities proposed by operators in the area, but these inventories were generally limited to an inventory of historic nests within a ½-half mile radius of each proposed federal action. There are approximately 10 known raptor nests and 42 historic raptor nests known to exist within the project area as a result of these past inventories. Between these two different nest types, there is an overlap, and an exact number of nests cannot be calculated. A comprehensive survey of raptor nests will be conducted for each individual project when the APD is processed.

Map 5 shows raptor nests, black-tailed prairie dog towns, and the one sage-grouse lek known to exist within the project area.

Threatened and Endangered Species

Threatened and endangered (T&E) species include those species that are in danger of extinction due to habitat degradation and drastic population declines. They are listed as threatened or endangered pursuant to the ESA, as amended. A discussion of those T&E species which occur within the CFO administrative boundary follows.

Black-footed Ferret (*Mustela nigripes*). The black-footed ferret (endangered) depends on their primary prey, prairie dogs, for continued existence. Although prairie dog towns are present within the project area, there have been no documented occurrences or reintroductions.

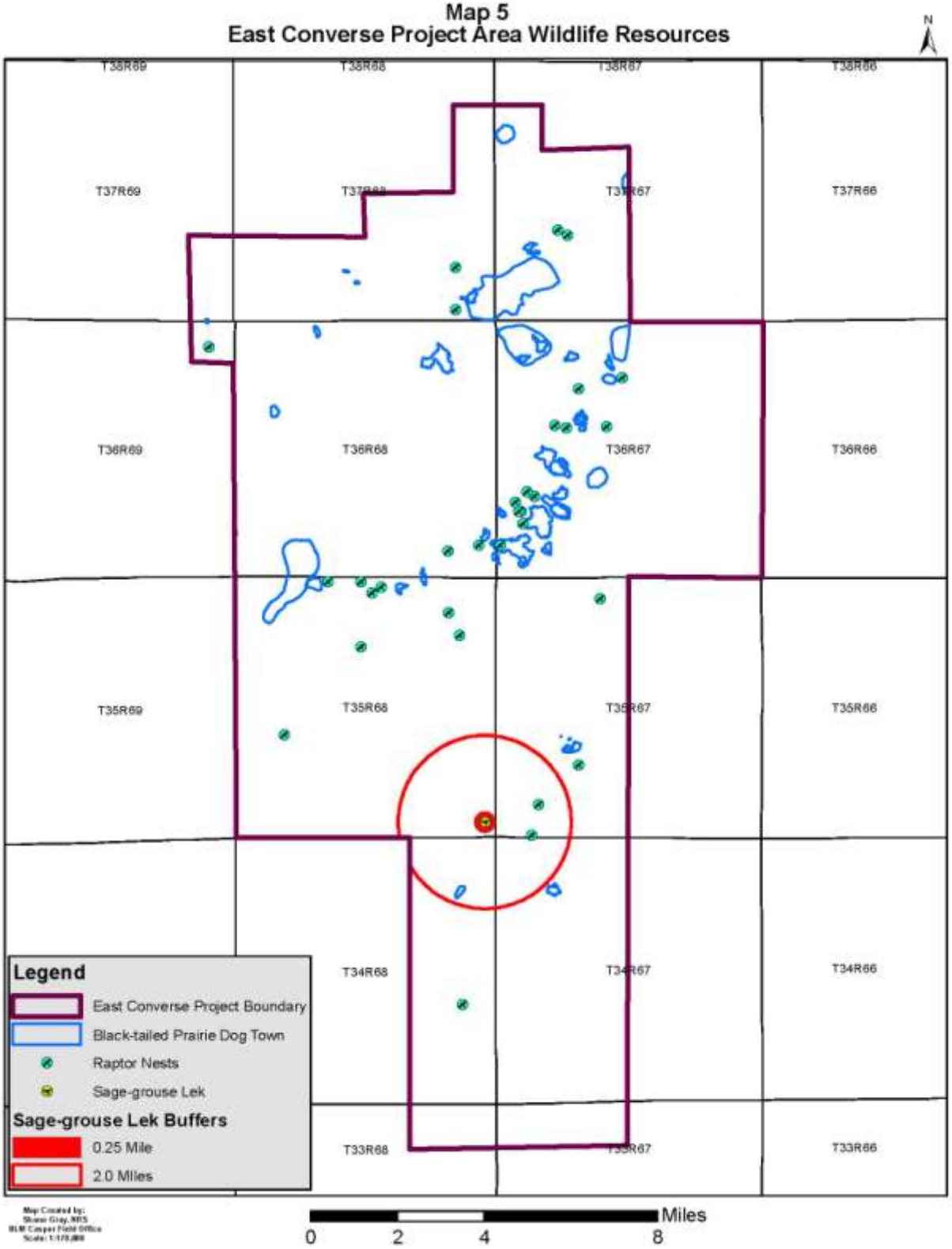
Colorado Butterfly Plant (*Gaura neomexicana* ssp*. coloradensis).* Colorado butterfly plant (threatened) typically occurs in colonies on sub-irrigated alluvial soils, on level or slightly sloping floodplains and drainage bottoms, at elevations of 5,000 to 6,400 feet. The project area is located outside of the geographic range of this species.

Designated Critical Habitat for Colorado Butterfly Plant. There is no designated critical habitat for this species within the project area.

Ute Ladies'-Tresses Orchid (*Spiranthes diluvialis*). Ute ladies' tresses orchid (threatened) occurs primarily on low, flat, floodplain terraces or abandoned oxbows close to perennial streams on alluvial soils between 1,500 and 7,000 feet. There are no documented populations within the project area. In addition, there is no documented potentially suitable habitat located within the project area.

Blowout Penstemon (*Penstemon haydenii*). Blowout penstemon (endangered) grows in wind-carved depressions in sparsely vegetated active sand dunes. There are no known populations located within the project area. There is no potentially suitable habitat within the project area.

Map 5
East Converse Project Area Wildlife Resources



Prebles Meadow Jumping Mouse (*Zapus hudsonius preblei)* Preble's meadow jumping mouse, a threatened species, is strongly associated with foothills and plains riparian areas that have dense, herbaceous riparian vegetation. The project area is located outside of the geographic range of this species.

Species Affected by North Platte River Water Depletions. North Platte River species are those species that may occur in the downstream riverine habitats of the North Platte River in Nebraska, but could be adversely affected by water depletions in the North Platte River system resulting from project-related activities. These species and their status are listed below.

1) Interior least tern *(Sterna antillarum)* - endangered;
2) Piping plover *(Charadrium melodus)* - threatened;
3) Pallid sturgeon *(Scaphirhynchus albus)* - endangered;
4) Whooping crane *(Grus americana)* - endangered; and
5) Western prairie fringed orchid *(Platanthera praeclara)* - threatened.

Within the project area, there are no hydrologically connected sub-basins to the North Platte River watershed. If water is obtained from outside the project area that is within a hydrologically connected sub-basin and exceeds 0.1 acre/feet then consultation with the FWS will be required.

BLM Sensitive Species

BLM sensitive species are those species that need special management considerations. Table 3.9 lists BLM sensitive species that occur within the CFO and their habitat preferences. The sensitive animal and plant species potentially occurring in the overall project area include Bairds sparrow, bald eagle, black-tailed prairie dog, Brewer's sparrow, burrowing owl, ferruginous hawk, Greater sage-grouse, loggerhead shrike, long-billed curlew, mountain plover, sage sparrow, sage thrasher, and swift fox.

Bairds Sparrow. The Bairds sparrow is a short- to medium-distance migrant within North America and occurs in eastern Wyoming, mostly during migration. This species is a grassland specialist and requires an area of about 63 hectares (ha) during breeding season (Luce and Keinath 2003). There are no documented occurrences of this bird within the project area.

Bald Eagle. Bald eagles occurs near large lakes and rivers in forested areas where adequate prey and old, large-diameter cottonwood or conifer trees are available for nesting (FWS 2004). The bald eagle was delisted from its threatened status under the federal Endangered Species Act and in losing federal status; it is designated as sensitive in Wyoming.

One bald eagle nest has been identified in the project area. This nest is located in the SENE, sec. 29, T. 35 N., R. 67 W. on private land. No known winter communal roosts have been identified in the project area. However, there are six documented occurrences of bald eagles within the project area.

Black-tailed Prairie Dog. Black-tailed prairie dogs historically inhabited short-grass and mixed-grass prairies throughout the United States. Many special status wildlife species are found in prairie dog towns, including the black-footed ferret, as well as burrowing owl, mountain plover, and swift fox (map 5).

There are 61 known black-tailed prairie dog towns throughout the project area. These towns range in size from less than 1 acre to more than 1,000 acres, with a combined total of 4,932 acres, or 3.93% of the entire project area. At the time of APD processing, a comprehensive survey of prairie dog towns will be conducted.

Brewers Sparrow. The Brewers sparrow is considered a common summer resident in Wyoming and occurs throughout most of the state (WGFD 2005). This bird is a sagebrush obligate. There are no documented occurrences of the Brewers sparrow within the project area.

Burrowing Owl. In Wyoming, the burrowing owl's highest concentration is in the south and east, although burrowing owls occur and breed throughout most of the state (WGFD 2006). This species require short-grass habitats and prefer open areas within grasslands, deserts, and shrub-steppes (McDonald et al. 2004). The availability of burrows is the limiting factor in burrowing owl habitat (Lantz et al. 2004). There are no documented occurrences of the burrowing owl within the project area.

Ferruginous Hawk. The ferruginous hawk breeds across a large portion of Wyoming, and some individuals are found during winter in the southern part of the state. This species occupies arid and open grassland, and shrub-steppe (Travsky and Beauvais 2005). Ferruginous hawks rely on large areas of native grass and shrubs with abundant prairie dogs, other ground squirrels, and jackrabbits (Travsky and Beauvais 2005).In addition, this species is sensitive to human activities and disturbances during the breeding season and appears to have high site fidelity (Travsky and Beauvais 2005; Gillihan et al. 2004). There is one documented ferruginous hawk occurrence within the project area.

Table 3.9. Wyoming BLM Sensitive Species and Habitat Preference

Species		Preferred Habitat	Likely to Occur[a]
Common Name	Scientific Name		
MAMMALS			
Long-eared myotis	*Myotis evotis*	Conifer and deciduous forests, caves and mines	N
Fringed myotis	*Myotis thysanodess*	Conifer forests, woodland-chaparral, caves and mines	N
Spotted bat	*Euderma maculatum*	Cliffs over perennial water, basin-prairie shrub	N
Townsend's big-eared bat	*Corynorhinus townsendii*	Forests, basin-prairie shrub, caves and mines	N
White-tailed prairie dog	*Cynomys leucurus*	Basin-prairie shrub, grasslands	N
Black-tailed prairie dog	*Cynomys ludovicianus*	Basin-prairie shrub, grasslands	Y
Swift fox	*Vulpes velox*	Grasslands	Y
BIRDS			
White-faced Ibis	*Plegadis chihi*	Marshes, wet meadows	N
Trumpeter swan	*Cygnus buccinator*	Lakes, ponds, rivers	N
Bald eagle	*Haliateetus leucocehalus*	Conifer and deciduous forests, trees, grasslands	Y
Northern goshawk	*Accipter gentiles*	Conifer and deciduous forests	Y
Ferruginous hawk	*Buteo regalis*	Basin-prairie shrub, grassland, rock out-crops	Y
Peregrine falcon	*Falco peregrinus*	Tall cliffs	N
Greater sage-grouse	*Centrocercus urophasianus*	Basin-prairie shrub, mountain-foothill shrub	Y
Long-billed curlew	*Numenius americanus*	Grasslands, plains, foothills, wet meadows	Y
Yellow-billed cuckoo	*Coccyzus americanus*	Open woodlands, streamside willow and alder groves	N
Burrowing owl	*Athene cunicularia*	Grasslands, basin-prairie shrub	Y
Sage thrasher	*Oreoscoptes montanus*	Basin-prairie shrub, mountain-foothill shrub	Y
Loggerhead shrike	*Lanius ludovicianus*	Basin-prairie shrub, mountain-foothill shrub	Y
Brewer's sparrow	*Spizella breweri*	Basin-prairie shrub	Y
Sage sparrow	*Amphispiza billineata*	Basin-prairie shrub, mountain-foothill shrub	Y
Baird's sparrow	*Ammodramus bairdii*	Grasslands, weedy fields	Y
Mountain plover	*Charadrius montanus*	Shortgrass, great basin-foothills grass-land, and sagebrush-grasslands	Y
AMPHIBIANS			
Northern leopard frog	*Rana pipiens*	Beaver ponds, permanent water in plains and foothills	Y
PLANTS			
Laramie columbine	*Aquilegia laramiensis*	Crevices of granite boulders and cliffs 6,400-8,000 feet	N
Porter's sagebrush	*Artemesia porteri*	Sparsely vegetated badlands of ashy or	N

Species		Preferred Habitat	Likely to Occur[a]
Common Name	Scientific Name		
		tufaceous mudstone and clay slopes; 5,300 to 6,500 feet	
Many-stemmed spider flower	*Cleome multicaulis*	Semi-moist, open saline banks of shallow ponds, lakes with Baltic rush and bulrush, 5,900 feet	N
Williams' wafer parsnip	*Cymopterus williamsii*	Open ridge tops and upper slopes with exposed limestone outcrops or rockslides, 6,000 to 8,300 feet	N
Laramie false sagebrush	*Sphaeromeria simplex*	Cushion plant communities on rocky limestone ridges and gentle slopes, 7,500 to 8,600 feet	N
Limber pine	*Pinus flexilis* James	Limber pine grows on a variety of topographies, from gently rolling terrain to cliffs. It is most often found on rocky ridges and steep rocky slopes and can survive in extremely windswept areas at both lower and upper tree line. Often found in open and dry environments, and is typical on exposed, rocky mountain-sides. It may be found from low elevations of about 4,000 feet to timberline.	N

Greater Sage-grouse. The Greater sage-grouse occurs throughout Wyoming where sagebrush is present. This species depends upon sagebrush habitat. Suitable habitat consists of plant communities dominated by sagebrush and a diverse native grass and forb understory. Suitable winter habitat requires sagebrush above snow (USRB Working Group 2008; Connelly et al. 2004). Abundance has declined, primarily as a result of loss, fragmentation, and degradation of sagebrush habitat.

Greater sage-grouse nesting and early brood-rearing habitat in Wyoming is generally described as sagebrush stands having 15 to 30% canopy cover and shrub heights of 11 to 32 inches (40 to 80 centimeters [cm]). Grasses and forbs with height (6 inches (15 cm) or greater) and shrub canopy cover (greater than 15%) provides important cover and food for sage-grouse using these habitats. Early brood-rearing habitat has 10 to 25% sagebrush canopy cover and a slightly higher canopy cover of grasses and forbs than nesting habitat. Sage-grouse hens with chicks generally use early brood-rearing habitat when the chicks range in age from newly hatched up to 21 days of age.
.
Greater sage-grouse lek habitat is typically an open area surrounded by potential nesting habitat. The common feature of leks is that they have less shrub and herbaceous cover than surrounding habitats. The sagebrush that surrounds a lek provides important hiding cover from predators for both the male sage-grouse and particularly hens while attending a lek. Sagebrush cover immediately adjacent to a lek may or may not be productive, high-quality nesting habitat.

There is one historic Greater sage-grouse lek (Manning Road) known to occur within the project area (map 5). The Manning Road lek, located on state land in the east central portion of the project area, is classified as occupied, although recent surveys (2011) have not shown activity. A small portion of the Thunder Basin sage-grouse core area lies in the northwestern part of the project area encompassing 21 acres and less than 1% of the total project area. At the time of APD processing, a comprehensive survey of suitable sage-grouse habitats will be conducted. If an APD were submitted within the ~~north Glenrock~~ Thunderbasin core area, a density disturbance calculation tool (DDCT) would be prepared and submitted to the WGFD for review, in compliance with BLM Wyoming Instruction Memorandum (WY-IM-2012-019).

Loggerhead Shrike. Important habitat characteristics for the loggerhead shrike are the presence of dense shrubs or trees for nesting with nearby open herbaceous areas for foraging (grasslands or pastures) and a high perch density (Keinath and Schneider 2005). There is one documented occurrence of the loggerhead shrike within the project area.

Long-billed Curlew. The long-billed curlew occurs in a variety of grasslands communities, from shortgrass prairies to cultivated hay fields to sagebrush-grasslands (Dark-Smiley and Keinath 2004). This species has high habitat specificity for its breeding, wintering, and foraging habitats (Dark-Smiley and Keinath 2004). There is one documented occurrence of the long-billed curlew within the project area.

Mountain Plover. The mountain plover nests in grasslands, mixed grassland areas, short-grass prairie, shrub steppe, cultivated lands, and prairie dog towns. This species has a narrow range of habitat requirements and appears to have a high degree of site fidelity (Smith and Keinath 2004; Dismore 2003). There are no documented observations of the mountain plover within the project area.

Sage Sparrow. The sage sparrow occurs in the summer throughout most of the state where sagebrush is present (WGFD 2005). These birds prefer large and undisturbed tracts of tall, dense sagebrush. They are common in Wyoming, and populations are declining (WGFD 2005). There have been no documented observations of the sage sparrow within the project area.

Sage Thrasher. The sage thrasher is considered a common summer resident and occurs throughout most of Wyoming where sagebrush is present (WGFD 2005). Sage thrashers are sagebrush obligates and seem to be quite selective in sites used for nesting and breeding habitat (Buseck et al. 2004). There are no documented occurrences of the sage thrasher within the project area.

Swift Fox. The swift fox occurs in the northeastern, east-central, southeastern, and south-central portions of the state (WGFD 2006). Swift foxes require large open areas of prairie and grassland habitats (Dark-Smiley and Keinath 2003). There are no documented occurrences of swift fox within the project area.

Migratory Bird Species

Migratory birds migrate for breeding and foraging at some point in the year. The BLM-FWS MOU (2010) promotes the conservation of migratory birds, as directed through Executive Order 13186 (*Federal Register* V. 66, No. 11). BLM must include migratory birds in every NEPA analysis of actions that have potential to affect these bird species of concern to fulfill obligations under the Migratory Bird Treaty Act (MBTA).

Habitats occurring within the project area include sagebrush steppe grasslands, ponderosa pine, and mixed grass prairie. Many species of high management concern use these areas for their primary breeding habitats (Saab and Rich 1997). Nationally, grassland and shrubland birds have declined more consistently than any other ecological association of birds over the last 30 years (WGFD 2009). The FWS's Birds of Conservation Concern (BCC 2008) report identifies species of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the ESA.

The Wyoming Bird Conservation Plan (Nicholoff 2003) identified three groups of high-priority bird species in Wyoming: level I –species that clearly need conservation action; level II – species where the focus should be on monitoring, rather than active conservation; and, level III – species that are not high priority but are of local interest. Table 3.10 lists those species that are likely to occur in the project area.

Table 3.10. Migratory Birds Potentially Occurring in the Project Area

Level	Species	Wyoming BLM Sensitive
Level I	Baird's sparrow	Yes
	Bald eagle	Yes
	Brewer's sparrow	Yes
	Burrowing owl	Yes
	Ferruginous hawk	Yes
	Long-billed Curlew	Yes
	McCown's longspur	No
	Mountain plover	Yes
	Sage sparrow	Yes
	Short-eared owl	No
	Swainson's hawk	No
	Upland sandpiper	No
Level II	Chestnut-collard longspur	No
	Dickcissel	No
	Grasshopper sparrow	No
	Lark bunting	No
	Lewis' Woodpecker	No

Level	Species	Wyoming BLM Sensitive
	Loggerhead shrike	Yes
	Sage thrasher	Yes
Level III	Golden eagle	No
	Red-headed Woodpecker	No
Source: Nicholoff 2003.		

Hazardous or Solid Wastes

Hazardous materials that would be used at the site may include drilling mud and cementing products, fuels, flammable or combustible materials, and corrosive acids and gels.

WTDOT, under 49 CFR, Parts 171–180, regulates the transportation of hazardous materials to the well location. Potentially hazardous substances used in the development or operation of wells shall be kept in limited quantities on well sites and at the production facilities for short periods.

The concentration of nonexempt hazardous substances in the reserve pit at the time of pit backfilling would not exceed the standards set forth in CERCLA as amended by the SARA. All oil and gas drilling-related CERCLA hazardous substances removed from a location and not reused at another drilling location would be disposed of in accordance with applicable federal and state regulations. Only those hazardous wastes that qualify as **exempt,** under RCRA may be disposed of in the reserve pit.

Public Health and Safety

Public health and safety is addressed in operator-specific SPCC plans and aboveground storage tanks (ASTs), as mandated by federal and state regulations through the EPA and the WDEQ. For federal oil pollution prevention regulations (SPCC plans), see 40 CFR 112, for ASTs, see Wyoming Water Quality Rules and Regulations (WWQR&R) 17.36. EPA administers and enforces the SPCC regulations and WDEQ administers the regulations for ASTs.

CHAPTER 4: ENVIRONMENTAL EFFECTS

Introduction

An environmental impact is a change in the quality or quantity of a given resource because of a modification in the existing environment resulting from a project-related activity. Impacts can be beneficial or adverse; a primary (direct) result or a secondary (indirect) result of an action; long-term (more than five years) or short-term (less than five years), and can vary in degree from a slightly discernible change to a total change in the environment. Potential impacts are quantified when possible; however, when impacts are not quantifiable suitable adjectives are used to best describe the level of impact and relevant mitigation measures are applied where appropriate.

The potential environmental consequences associated with the No Action Alternative, the Proposed Action Alternative, and the Agency Alternative are addressed below under each affected resource in a 'common to all alternatives' sub section, as all the alternatives involve the construction, drilling, completion, and maintenance activities described in chapter 2 of the Proposed Action and alternatives. The differences between the alternatives are essentially the degree of impacts, as each alternative has differences in the number of well pads/locations and a different ratio of wells per well pad/location. The potential environmental consequences and the extent of the differences by alternative are discussed below for each potentially affected resource, in accordance with 40 CFR 1502.16.

DIRECT AND INDIRECT EFFECTS

Air Resources

Air Quality and Visibility

Impacts Common to All Alternatives

Air quality impacts from the proposed activities would result from construction, drilling, completion, and production activities.

Air quality impacts associated with oil and natural gas wells derive from several sources

- Fugitive dust during well pad construction, access road construction and improvements, earth moving equipment, and from vehicular traffic on unpaved roads;
- Suspended particulates (dust) from wind erosion on bare construction areas;
- Hydrocarbon emissions from vehicle engines, drill rigs, heavy equipment related to drilling, and operation of gasoline and diesel engines;

- Gas venting or flaring during well completion and development activities;

- Gas production from the well pads may result in localized reductions in air quality due to odors and emissions from the well pad sites.

Impacts caused by the proposed activities, primarily from vehicle exhaust and increased fugitive dust during construction, would be low and short-term (less than one year). Wind dispersion and dilution would reduce these impacts, and the impacts are considered negligible beyond the well site boundaries. Air quality would decrease during construction of the well pads, roadwork, and wells. Pollutants generated during these activities include combustion emissions and fugitive dust associated with construction equipment and vehicles. Once construction activities are complete, air quality impacts associated with these activities would also cease.

Vent emissions from tanks and natural gas dehydrators would be controlled by routing the emissions to a flare or similar control device, which would reduce emissions by 95% or greater. This control measure would reduce volatile organic compounds and hazardous air pollution emissions from the project.

Visibility Impacts from all alternatives would result primarily from vehicle exhaust and increased fugitive dust during construction. Impacts would be localized and short-term (less than one year). Wind dispersion and dilution would reduce these impacts, and the impacts are considered negligible beyond the well site boundaries.

No Action Alternative

The No Action Alternative would respond to individual APDs on a case-by-case basis, and potentially 66 new well locations could be processed.

The no action alternative yields the highest amount of acres disturbed. Consequently, the potential and extent of impacts to air quality and visibility would be the highest of the three alternatives.

Proposed Action Alternative

The Proposed Action Alternative consists of 18 well pads with a total of 21 wells in the following configurations: 15 single well pads and 3 two-well pads.

The combination of lower number of well pads/ locations and the co-location (on the same well pad/ location) of some of the proposed wells, the proposed action yields less acres of disturbance when compared to the no action alternative. Consequently, the potential and extent of impacts to air quality and visibility would be approximately 73% less from surface disturbance sources and 68% less from emission causing sources, when compared to the no action alternative.

Agency Alternative

The Agency Alternative consists of 18 well pads with a range of 18 to 72 wells, assuming a range of one to four wells per well pad/location.

The agency alternative yields approximately the same amount of acres disturbed as the proposed action. Due to the co-location (on the same well pad/ location) of up to four wells per well pad/ location the agency alternative yields the most consolidated footprint and the most shared acres of disturbance. Consequently, the potential and extent of impacts to air quality and visibility from surface disturbances, would be the same as the proposed action at the smallest development ratio (one well per well pad/ location) and the lowest of the three alternatives at the largest development ratio (four wells per well pad/ location) when compared to the no action alternative.

The potential and extent of air quality and visibility impacts from emission causing sources for the agency alternative would be approximately 73% less when compared to the no action alternative and 14% less when compared to the proposed action at the smallest development ratio (one well per well pad/ location) and approximately 70% higher when compared to the proposed action and 8% higher when compared to the no action alternative at the largest development ratio (four wells per well pad/ location).

However, the agency alternative has the greatest potential to reduce the number of acres disturbed, miles of access roads and pipelines required; therefore, substantially reducing the emission causing sources as a result of co-location when compared to the no action alternative and the proposed action.

Green House Gas Emissions

Impacts Common to All Alternatives

The Center for Climate Strategies (CCS) prepared the *Wyoming Greenhouse Gas Inventory and Reference Case Projections 1990-2020 (Inventory)* for the WDEQ through an effort of the Western Regional Air Partnership (WRAP). This *Inventory* report presented a preliminary draft GHG emissions inventory and forecast from 1990 to 2020 for Wyoming. The report provides an initial comprehensive understanding of Wyoming's current and possible future GHG emissions. The information presented provides the state with a starting point for revising the initial estimates as improvements to data sources and assumptions are identified.

The *Inventory* report discloses that activities in Wyoming accounted for approximately 56 million metric tons (mmt) of *gross* carbon dioxide equivalent (CO_{2e}) emissions in 2005, an amount equal to 0.8% of total US gross GHG emissions. These emission estimates focus on activities in Wyoming and are *consumption-based;* they exclude emissions associated with electricity exported from the state. Wyoming's gross GHG emissions increased 25% from1990 to 2005, while national emissions rose by only 16% from 1990 to 2004. Annual removal of GHG emissions due to forestry and other

land-uses in Wyoming are estimated at 36 mmtCO_{2e} in 2005. Wyoming's per capita emission rate is more than four times greater than the national average of 25 mmtCO_{2e}/yr.

Methane emissions from the fossil fuel industry were 13.5 mmt CO_{2e} in 2005. Of this, 11.4 mmt are contributions from the natural gas and oil industry, the remainder was from coal mining.

This large difference between national and state per capita emissions occurs in most of the sectors--Wyoming's emission per capita considerably exceeds national emissions per capita for electricity, industrial, fossil fuel production, transportation, industrial process, and agriculture. The state's strong fossil fuel production and other industries with high fossil fuel consumption intensity, large agriculture industry, and large distances could be the reasons for the higher per capita intensity in Wyoming. This phenomenon is primarily the result of a low population base (small denominator). Between 1990 and 2005, per capita emissions in Wyoming increased, mostly due to increased activity in the fossil fuel industry, while national per capita emissions have changed relatively little.

Wyoming's gross GHG emissions are expected to continue to grow to 69.4 mmtCO_{2e} by 2020, 56% above 1990 levels. As shown in figure ES-3 of the *Inventory,* demand for electricity is projected to be the largest contributor to future emissions growth, followed by emissions associated with transportation. Although GHG emissions from fossil fuel production had the greatest increase by sector from 1990 to 2005, the growth from this sector is projected to decline due to the assumption that carbon dioxide emissions from venting at processing plants would decrease.

Table 4.1 compares the total of producing wells in Wyoming to those producing wells on federal lands within the High Plains DO and field office administrative areas.

Table 4.1. Distribution of Producing Wells in Wyoming in 2010

Location	Total Producing Wells	Federal Portion of Total Producing Wells
Statewide	59,500	30,500
High Plains District	39,500	18,000
Buffalo Field Office	31,000	12,500
Casper Field Office	5,000	4,000
Newcastle Field Office	3,000	1,500

This accounted for approximately 59% of the total federal wells in Wyoming and 66% of the total wells. Therefore, based on emissions from natural gas and oil industries in Wyoming, GHG emissions from all wells within the High Plains DO amounted to approximately 7.57 mmt annually (7.57 mmt X 0.66 = 5.00 mmt) assuming steady production and emission venting.

Projected GHG emissions are calculated based solely on the number of proposed wells for each alternative. Emissions of GHGs can occur at many stages of production, processing, transmission, and distribution of oil and gas. Co-location of multiple wells on a single pad has the potential to reduce the miles of pipeline as well as the number of production and storage facilities required. On a programmatic basis it is not possible to quantify the reduction in GHG emissions resulting from multiple well pads, but emissions on a per well basis should be less on multiple well pads than would result from individual wells spaced over a larger area.

No Action Alternative

Under the no action alternative, oil and gas development would occur on a case-by-case basis. Potentially 66 new well locations could be processed as 66 federal leases exist with valid and existing rights that are not currently held by production. 66 new federal wells would represent an increase of 0.17% to the total wells (39,500) included in air quality analysis. Assuming steady production and emission venting these wells could produce 0.013 mmt of GHG emissions annually.

Proposed Action Alternative

Under the proposed action, 18 well pads for 21 wells would be constructed. The 21 new federal wells would represent an increase of 0.05% to the total wells (39,500) included in air quality analysis. Assuming steady production and emission venting these wells could produce 0.004 mmt of GHG emissions annually.

The combination of the lower number of well pads/locations and the co-location (on the same well pad/location) of some of the proposed wells, the proposed action would have approximately 69% less GHG emissions when compared to the no action alternative and has potential to reduce the miles of pipeline as well as the number of production and storage facilities required slightly reducing the estimated GHG emissions as a result of co-location.

Agency Alternative

Under the agency alternative, 18 well pads with a range of 18 to 72 wells (one to four wells per well pad/ location) would be constructed. The range of 18 to 72 new federal wells would represent an increase of 0.05 to 0.18% to the total wells (39,500) included in air quality analysis. Assuming steady production and emission venting these wells could produce a range of 0.003 to 0.014 mmt of GHG emissions annually.

Due to the co-location (on the same well pad/location) of up to four wells per well pad/location this alternative yields the most consolidated footprint and the most shared acres of disturbance. The agency alternative would have approximately the same amount of increase in percentage of wells and slightly lower GHG emissions when compared to the proposed action and 77% less when compared to the no action alternative at the smallest development ratio (one well per well pad/ location). At the largest development ratio (four wells per well pad/ location), the agency alternative

would have approximately 71% more GHG emissions when compared to the proposed action and 7% more when compared to the no action alternative.

The agency action has the greatest potential to reduce the miles of pipeline as well as the number of production and storage facilities required; therefore, considerably reducing the estimated GHG emissions as a result of co-location when compared to the no action alternative and the Proposed action.

Mitigation Measures

Best management practices (BMPs) such as those used to reduce fugitive dust emissions, air quality, and greenhouse gas emissions would help mitigate effects to these resources. Further analysis at the APD and facility application stages of development may examine possible mitigations to alleviate site-specific impacts.

The BLM holds regulatory jurisdiction over portions of natural gas and petroleum systems identified in the EPA's I*nventory of US Greenhouse Gas Emissions and Sinks: 1990-2006* document. Exercise of this regulatory jurisdiction has led to development of BMPs designed to reduce emissions from field production and operations. Analysis and approval of future development on the lease parcels would include applicable and reasonable BMPs as conditions of approval in order to reduce or mitigate GHG emissions. Additional measures developed at the project development stage could be incorporated as COAs in the approved APD.

Such mitigation measures may include, but are not limited to:

- Flaring hydrocarbon and gases at high temperatures in order to reduce emissions of incomplete combustion through the use of multi-chamber combustors;
- "Green" (flareless) completions;
- Watering dirt roads during periods of high use to reduce fugitive dust emissions;
- Requiring that vapor recovery systems be maintained and functional in areas where petroleum liquids are stored;
- Installing liquids gathering facilities or central production facilities to reduce the total number of sources and minimize truck traffic;
- Use natural gas-fired or electric drill rig engines;
- Use selective catalytic reducers on diesel-fired drilling engines; and,
- Re-vegetate areas of the pad not required for production facilities to reduce the amount of dust.

According to the *Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2006* by the EPA, data shows that by industry adopting the EPA's Natural Gas Energy Star program, emissions from oil and gas exploration and development has been reduced. The BLM would work with industry to facilitate the use of the relevant BMPs for operations proposed on federal mineral leases where such mitigation is consistent with agency policy.

All proposed development activities would be reviewed when an APD is received. At the time of approval, further mitigation may be applied to reduce adverse impacts.

Heritage and Visual Resources

Cultural Resources

Impacts Common to All Alternatives

Impacts to fragile cultural resources normally result from surface-disturbing actions and those that introduce incompatible elements to the cultural landscape such as visual or audible. Essentially, any activity that creates or has the potential to create surface disturbance, regardless of the resource program to which it may be associated, can cause potential impacts to cultural resources.

The management of cultural resources is subject to a variety of laws and regulations and the BLM is mandated to comply with these. In particular, section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, requires the BLM to take into account the effect of any undertaking on significant cultural resources. Compliance is achieved through a national programmatic agreement and a subsequent state protocol agreement between the Wyoming BLM and the Wyoming SHPO (2006). Together, these agreements outline how BLM will meet its responsibilities under the NHPA. All BLM undertakings follow these agreements and in particular, the Wyoming protocol agreement. The agreements outline the processes for project planning, identification of resources, determination of eligibility, determination of effect, resolution of adverse effects, and unanticipated discovery situations.

No Action Alternative

Impacts to cultural resources can occur with any type of surface disturbing activity. The no action alternative yields the highest amount of acres disturbed. Consequently, the potential for impacts to cultural resources would be the highest under the three alternatives analyzed.

Proposed Action Alternative

Impacts to cultural resources can occur with any type of surface disturbance activity. With the lower number of well pad/locations and the co-location (on the same well pad/location) of some of the proposed wells, the proposed action yields less acres of disturbance when compared to the no action alternative. Consequently, the potential for impacts to cultural resources would be approximately 73% less when compared to the no action alternative.

Agency Alternative

Impacts to cultural resources can occur with any type of surface disturbance. The agency alternative yields approximately the same amount of acres disturbed as the proposed action. Due to the co-location (on the same well pad/location) of up to four wells per pad/location, the agency alternative yields the most consolidated footprint and the most shared acres of disturbance. Consequently, the potential for impacts to the cultural resources would be the same as those discussed for the proposed action at the smallest development ratio (one well pre pad/location) and the lowest of the three alternatives at the largest development ratio (four wells per well pad/location) when compared to the no action alternative.

Mitigation Measures

In general, three best management practices guide all undertakings. Simply stated these are, in order of preference: avoid, minimize, and mitigate. Significant sites will be avoided if possible. If sites cannot be avoided, the undertaking will minimize its physical surface imprint and a variety of design and coloring techniques will be implemented to minimize its impact to a no effect or no adverse effect determination. If the previous steps do not achieve a no effect or no adverse effect finding then a mitigation plan will be developed in conjunction with BLM, SHPO, the Advisory Council on Historic Preservation (ACHP), and interested parties.

All BLM permitted activities in the study area will contain the following standard cultural stipulation:

> The permittee is responsible for informing all persons in the area who are associated with this project that they will be subject to prosecution for knowingly disturbing historic or archaeological sites, or for collecting artifacts. If historic or archaeological materials are uncovered during construction, the operator is to immediately stop work that might further disturb such materials, and contact the Authorized Officer of the BLM Casper Field Office. Within five working days the Authorized Officer will inform the operator as to: (1) whether the materials appear eligible for the National Register of Historic Places; (2) the mitigation measures the operator will likely have to undertake before the site can be used (assuming in situ preservation is not necessary); and, (3) a timeframe for the Authorized Officer to complete an expedited review under 36 CFR 800.11 to confirm,

through the State Historic Preservation Officer, that the finds of the Authorized Officer are correct and that mitigation is appropriate. The Authorized Officer will provide technical and procedural guidelines for the conduct of mitigation. Upon verification from the Authorized Officer that the required mitigation has been completed, the operator will then be allowed to resume construction measures.

Decision # 5008 of the Casper RMP states, "Cultural resource inventories and site evaluations within the planning area are in direct response to specific land-use proposals in accordance with section 106 of the NHPA. Additional inventory is carried out, when resources permit, to comply with section 110 of the NHPA. Block inventories will be applied when full field development occurs at a spacing of one well per 80-acres or less."

Paleontology

Impacts Common to All Alternatives

Construction activities associated with mineral exploration have the potential to uncover and disturb fossil materials. Negative impacts to fossil localities are most likely to occur where construction activities will disturb bedrock outcrop areas. There is an overall moderate potential for the study area to contain fossil materials, and localities are not common within the area. Known formations with significant fossils are absent in the project area and, so mineral extraction activities have a low to moderate potential to adversely affect the resource.

If paleontological resources are discovered due to construction activities, mitigation actions consist of stabilizing the resource in place and avoiding further disturbance to the fossil resource, develop a strategy to professionally excavate the resource, or develop another mitigation plan after consulting with the operator to accommodate the construction activity and protection of the significant resource.

No Action Alternative

Impacts to the paleontological resource occur with surface disturbance. The no action alternative yields the highest amount of acres disturbed. Consequently, the potential for impacts to the paleontological resources would be the highest of the three alternatives.

Proposed Action Alternative

Impacts to the paleontological resource occur with surface disturbance. The combination of lower number of well pad/locations and the co-location (on the same well pad/location) of some of the proposed wells, the proposed action yields less acres of disturbance when compared to the no action alternative. Consequently, the potential for impacts to the paleontological resources would be approximately 73% less when compared to the no action alternative.

Agency Alternative

Impacts to the paleontological resource occur with surface disturbance. The agency alternative yields approximately the same amount of acres disturbed as the proposed action. Due to the co-location (on the same well pad/location) of up to four wells per well pad/location, the agency alternative yields the most consolidated footprint and the most shared acres of disturbance. Consequently, the potential for impacts to the paleontological resources would be the same as the proposed action at the smallest development ratio (one well per well pad/location) and the lowest of the three alternatives at the largest development ratio (four wells per well pad/location) when compared to the no action alternative.

Mitigation Measures

All BLM permitted activities in the study area will contain the following standard paleontology stipulation:

> "The permittee shall immediately notify the BLM Authorized Officer of any paleontological resources discovered as a result of operations under this authorization. The permittee shall suspend all activities in the vicinity of such discovery until notified to proceed by the Authorized Officer and shall protect the discovery from damage or looting. The permittee may not be required to suspend all operations if activities can be adjusted to avoid further impacts to a discovered locality or be continued elsewhere. The Authorized Officer will evaluate, or will have evaluated, such discoveries as soon as possible, but not later than 10 working days after being notified. Appropriate measures to mitigate adverse effects to significant paleontological resources will be determined by the Authorized Officer after consulting with the operator. Within 10 days, the operator will be allowed to continue construction through the site, or will be given the choice of either (1) following the Authorized Officer's instructions for stabilizing the fossil resource in place and avoiding further disturbance to the fossil resource, or (2) following the Authorized Officer's instructions for mitigating impacts to the fossil resource prior to continuing construction through the project area."

Visual Resources

Impacts Common to All Alternatives

Anything that draws the viewer's attention and contrasts with the basic elements (form, line, color, or texture) of a given landscape, impacts the viewer's perceptions, creating impact to the visual resources. Changes from any source that introduces intrusive elements into the existing landscape could impact visual resources. Direct impacts resulting from on-the-ground activities may be either adverse or beneficial. Adverse impacts include the addition of visual intrusions, such as roads and facilities, or the

removal of natural materials (i.e., soil, vegetation). Beneficial impacts are normally a direct result of post-disturbance reclamation efforts. Indirect impacts relate to the management of other resource values, that occur on lands not administered by the BLM (regardless of ownership) can impact the visual resource of the adjacent public lands.

The East Converse project area is entirely within VRM class IV.

Class IV – to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of the viewer attention. However, every attempt should be made to minimize the impacts of these activities through careful location, minimal disturbance, and repeating basic elements.

An impact to the visual quality of the landscape occurs when a management activity creates noticeable surface disturbance that contrasts with form, line, color, or texture in the landscape. Even when such activities meet the established VRM objectives, they should be mitigated, where possible.

No Action Alternative

Impacts to visual resources can occur with any type of surface disturbing activity. The no action alternative yields the highest amount of acres disturbed. Consequently, the potential for impacts to visual resources would be the highest under the three alternatives analyzed.

Proposed Action Alternative

Impacts to visual resources can occur with any type of surface disturbance activity. The combination of the lower number of well pad/locations and the co-location (on the same well pad/location) of some of the proposed wells, the proposed action yields less acres of disturbance when compared to the no action alternative. Consequently, the potential for impacts to visual resources would be approximately 73% less when compared to the no action alternative.

Agency Alternative

Impacts to visual resources can occur with any type of surface disturbance. The agency alternative yields approximately the same amount of acres disturbed as the proposed action. Due to the co-location (on the same well pad/location) of up to four wells per pad/location, the agency alternative yields the most consolidated footprint and the most shared acres of disturbance. Consequently, the potential for impacts to the visual resources would be the same as the proposed action at the smallest development ratio (one well pre pad/location) and the lowest of the three alternatives at the largest development ratio (four wells per well pad/location) when compared to the no action alternative.

Mitigation Measures

Decision # 5007, states, “VRM classifications only apply to public surface and federal mineral estate.”

Further management direction and mitigation measures will be applied, where possible as described in the Washington Office Visual Resource Manual Series (MS8400).

Range Management

Impacts Common to All Alternatives

Reduction in forage would occur for both wildlife and livestock, and a potential loss in AUMs for each affected allotment could occur under all alternatives. This reduction would be a result of the construction activities from exploratory drilling including but not limited to construction of well pads, access roads, and pipelines. To analyze the impacts of the three alternatives, an average of 6.56 acres/AUM (based on 13,087 BLM acres within the allotments that intersect the project area) was used to determine impacts to available forage.

Road and pipeline construction could damage existing range improvements such as fences. Increased traffic on roads may disrupt ranching operations and increase the risk of vehicle collisions with livestock.

Construction activities and traffic on unpaved roads may result in increased accumulation of dust on plant vegetation. The degree of dust accumulation would depend on a variety of factors, including but not limited to, dust control measures, precipitation events to wash dust off vegetation, wind conditions, time between surface disturbance and reclamation, and frequency of vehicle traffic. The dust accumulation may affect forage palatability, photosynthetic capabilities, and health of the livestock from digestion of dust on forage in the area. This in turn could cause grazing lessees to change their management to avoid areas of disturbance.

No Action Alternative

Under the disturbance assumptions indicated for the no action alternative in chapter 2, the initial loss of approximately 969.54 acres of vegetation would result in a short-term reduction of 148 AUMs. The short-term reduction represents approximately 7% of the total AUMs within the project area

It is anticipated that approximately 408.82 acres would be reclaimed following reclamation. This would result in a long-term disturbance of 560.72 acres. Following reclamation, approximately 85 AUMs would be impacted long term, which represents 4% of total AUMs within the project area.

The no action alternative yields the highest amount of acres disturbed and reduces the largest amount of AUMs. Consequently, the potential and extent of impacts to livestock grazing and range management would be the highest of the three alternatives.

Proposed Action Alternative

Under the disturbance assumptions indicated for the proposed action in chapter 2, the initial loss of approximately 242.64 acres of vegetation would result in a short-term reduction of 37 AUMs. The short-term reduction represents approximately 2% of the total AUMs within the project area.

It is anticipated that approximately 103.07 acres would be reclaimed following reclamation. This would result in a long-term disturbance of 139.57 acres. Following reclamation approximately 21 AUMs would be impacted in the long term, which represents 1% of total AUMs within the project area.

The combination of lower number of well pad/locations and the co-location (on the same well pad/location) of some of the proposed wells, the proposed action yields less acres of disturbance when compared to the no action alternative. Consequently, the potential and extent of impacts to livestock grazing and range management would be approximately 75% less when compared to the no action alternative.

Agency Alternative

Under the disturbance assumptions indicated for the agency alternative in chapter 2, the initial loss of approximately 264.42 acres of vegetation would result in a short-term reduction of 40 AUMs. The short-term reduction represents approximately 2% of the total AUMs within the project area.

It is anticipated that approximately 111.50 acres would be reclaimed following reclamation. This would result in a long-term disturbance of 152.92 acres. Following reclamation approximately 23 AUMs would be impacted in the long term, which represents 1% of total AUMs within the project area.

The agency alternative yields approximately the same amount of acres disturbed as the proposed action. Due to the co-location (on the same well pad/location) of up to four wells per well pad/location, the agency alternative yields the most consolidated footprint and the most shared acres of disturbance. Consequently, the potential and extent of impacts to livestock grazing and range management would be the same as the proposed action at the smallest development ratio (one well per well pad/location) and the lowest of the three alternatives at the largest development ratio (four wells per well pad/location) when compared to the no action alternative.

Mitigation Measures

For short-term and long-term reductions in AUMs, the lessee can apply for a credit to the grazing lease annual bill on a yearly basis.

Soils and Ecological Sites

Impacts Common to All Alternatives

The impacts to soils would be the same for all the alternatives, as the actions across the alternatives are identical. The only differences between the alternatives are the degree of the impacts as related to the varying short-term and long-term acres of disturbance by alternative and summarized below.

Removal of native vegetation and disturbance of the underlying soil material as a result of surface disturbing activities associated with all the alternatives would increase the potential for loss of the existing soil resource through erosion. This potential would increase proportionately as degree of slope increases. Overall, soils within the project area generally have an adequate amount of topsoil available to ensure satisfactory reclamation, assuming the use of proper techniques designed to control erosion and ensure revegetation of the reclaimed areas are used. The disturbances to the soils would vary as a result of proposed well pad and road construction and upgrading, pipeline and utility line designs. Some soil mixing of surface layers with unsuitable subsurface horizons could occur.

The most notable impacts to soils would occur in association with construction of new well pads and roads. Grading and leveling would be required to construct or expand existing well pads with most of the greatest level of effort required on more steeply sloping areas. During construction, the soils would be mixed, resulting in a loss of soil structure. Soils would be compacted as a result of construction, and maintained by continued vehicle and foot traffic during operational activities. The potential for erosion would increase while soils are loose with no protective cover. Soil productivity would decrease, primarily as a result of profile mixing and compaction along with the loss in vegetative cover. A decrease in soil productivity also would occur in association with soil salvage and stockpiling activities because microbial action is curtailed, at least to some degree, in the constructed long-term stockpiles.

Impacts anticipated to occur on new roads include soil rutting and mixing, compaction, increased erosion potential, and loss of soil productivity. Because the running surface of new roads would be graveled, soil erosion and rutting over the long term would be minimal on new service roads. Increased vehicle traffic on existing natural surface roads may cause rutting during wet weather. If surface disturbance for pipelines and power lines were within existing roadways, additional impacts would be minimal.

No Action Alternative

The no action alternative would respond to individual APDs on a case-by-case basis, and potentially 66 new well locations could be processed. The short-term combined surface disturbance for construction, drilling, completion, and production of the no action alternative would yield a total of 969.54 acres of disturbance. The average short-term disturbance under this alternative would be 14.69 acres per well.

The long-term combined surface disturbance with consideration for reclamation would yield a total of 560.72 acres of disturbance for the ~~proposed~~ no action alternative. The average long-term disturbance for the 66 potential wells would be 8.50 acres per well.

The no action alternative yields the highest amount of acres disturbed. Consequently, the potential and extent of impacts to the soils and ecological sites would be the highest of the three alternatives.

Proposed Action Alternative

The proposed action alternative consists of 18 well pads with a total of 21 wells in the following configurations: 15 single well pads and 3 two-well pads. The short-term combined surface disturbance for construction, drilling, completion, and production would yield a total of 242.64 acres. The average short-term disturbance for the proposed 21 wells constructed on 18 well pad/ locations would be 11.55 acres per well.

The long-term combined surface disturbance with consideration for reclamation would yield a total of 139.57 acres of disturbance for the proposed action alternative. The average long-term disturbance for the proposed 21 wells constructed on 18 well pad/ locations is 6.65 acres per well.

The combination of a lower number of well pad/locations and the co-location (on the same well pad/location) of some of the proposed wells, the proposed action yields less acres of disturbance when compared to the no action alternative. Consequently, the potential and extent of impacts to the soils and ecological sites would be approximately 75% less when compared to the no action alternative.

Agency Alternative

The agency alternative consists of 18 well pads with a range of 18 to 72 wells, assuming one to four wells per well pad/location. The short-term combined surface disturbance for construction, drilling, completion, and production would yield 264.42 acres. The average short-term disturbance per well (18 to72) would be a range of 14.69 to 3.67 acres.

The long-term combined surface disturbance with consideration for reclamation would yield a total of 152.92 acres of disturbance for the agency alternative. The average long term disturbance would be a range of 8.50 to 2.12 acres per well (18 to 72 wells).

The agency alternative yields approximately the same amount of acres disturbed as the proposed action. Due to the co-location (on the same well pad/location) of up to four wells per well pad/location the agency alternative yields the most consolidated footprint and the most shared acres of disturbance. Consequently, the potential and extent of impacts to the soils and ecological sites would be the same as the proposed action at the smallest development ratio (one well per well pad/location) and the lowest of the three alternatives at the largest development ratio (four wells per well pad/location) when compared to the no action alternative.

Mitigation Measures

The site-specific reclamation plan associated with each well, road, and pipeline, as well as COAs, mitigation measures, and applicant-committed measures discussed in the COAs will help to mitigate or reduce the impacts described above. See Appendix D for reclamation guidelines. The following resource-specific BLM COAs will be implemented

1. The operator shall follow the guidance provided in the Wyoming Policy on Reclamation (IM WY-2012-032); for details see http://www.blm.gov/wy/st/en/programs/reclamation.html

2. The operator shall follow the guidance provided in the Wyoming Policy Management of Oil and Gas Exploration and Production Pits (IM WY-2012-007); for details see http://web.wy.blm.gov/Wy.im/12/wy2012-007.pdf

3. The operator shall follow the *Record of Decision and Approved Casper Resource Management Plan* (BLM 2007).

4. Individual site mitigation measures will vary by project location and circumstances and will be addressed during the application process within the applicant submitted Surface Use Plan of Operations.

5. Except as otherwise provided in an approved Surface Use Plan of Operations, the operator must not conduct operations in areas subject to mass soil movement, riparian areas, floodplains, lakeshores, and/or wetlands. The operator also must take measures to minimize or prevent erosion and sediment production. Such measures may include, but are not limited to:

    a. Avoiding steep slopes and excessive land clearing when siting structures, facilities, and other improvements; and

    b. Temporarily suspending operations when frozen ground, thawing, or other weather-related conditions would cause otherwise avoidable or excessive impacts.

    c. Utilizing erosion control methods such as but not limited to re-vegetating the disturbed areas as soon as possible, erosion control mats, waddles, mulch,

hydro-mulch, silt fences, water bars, eyebrow ditches, diversion ditches, wing ditches, gabion baskets or riprap and any other method approved by the Authorized Officer.

6. Lessees and operators must submit for BLM approval a request on Form 3160–5 before:

   a. Undertaking any subsequent new construction outside the approved area of operations; or

   b. Reconstructing or altering existing facilities including, but not limited to, roads, emergency pits, firewalls, flowlines, or other production facilities on any lease that will result in additional surface disturbance. If, at the time the original APD was filed, the lessee or operator elected to defer submitting information under Section III.E.3.d. (Location of Existing and/or Proposed Facilities) of ~~On Shore~~ Onshore Order Number One, the lessee or operator must supply this information before construction and installation of the facilities. The BLM may require a field inspection before approving the proposal. The lessee or operator may not begin construction until the BLM approves the proposed plan in writing. The operator must certify on Form 3160–5 that they have made a good faith effort to provide a copy of any proposal involving new surface disturbance to the private surface owner in the case of split estate.

7. The use of temporary protective surface treatment on disturbed areas shall be applied on a case-by-case basis as project conditions warrant.

8. Topsoil stored for a period greater than 90 days will not exceed piles of 3 feet in depth and will be seeded with a BLM approved seed mix to prevent wind and water erosion and to reduce the loss of microbial activity within the soil.

9. Re-seed all disturbed areas with native species adapted to the site conditions and capable of providing protective soil cover. All seed must be certified weed-free. When practical, reseeding of disturbed areas should include the use of locally harvested seed from comparable areas in Wyoming and surrounding states.

10. Surface disturbance or development on slopes greater than 25 percent is prohibited, unless individual site plans are submitted to and approved by the Authorized Officer meeting the following requirements. Engineered drawings for construction, site drainage design, and final rehabilitation contours with a written rational describing how the proposed controls will prevent slope failure and erosion, while maintaining viable topsoil for final reclamation. This plan should also include a timeline identifying the actions that will be applied during the construction, production, and rehabilitation phases of the plan so appropriate monitoring protocols can be developed by the BLM to ensure that the plan is meeting the objective described in its rationale.

11. Proposed surface-disturbing activities will be modified (located) to avoid areas of highly erosive soils to the greatest extent practicable. When avoidance of highly erosive soils is not practicable, the operator shall submit an individual site plan to ~~and~~ be approved by the Authorized Officer meeting the following requirements. Engineered drawings for construction, site drainage design, and final rehabilitation contours with a written rational describing how the proposed controls will prevent slope failure and erosion, while maintaining viable topsoil for final reclamation. This plan should also include a timeline identifying the actions that will be applied during the construction, production, and rehabilitation phases of the plan so appropriate monitoring protocols can be developed by the BLM to ensure that the plan is meeting the objective described in its rationale.

12. Soil compaction will be remediated on all compacted surfaces and prior to the redistribution of topsoil on disturbed surfaces to the depth of compaction by methods that prevent mixing of the soil horizons. BLM's recommended methods are subsoiling, paraplowing, or ripping with a winged shank Scarification is acceptable on areas identified as very shallow or shallow soils in the Master Surface Use Plan.

13. All pit spoil must be placed back in the pit once the pit is dry or fluids are removed. Subsoil must then be replaced in the reserve pit before topsoiling. Under no circumstances would any by-products from drilling or subsoil to be spread on top of topsoil. The pit area should usually be mounded slightly or restored to the original contour to allow for settling and positive surface drainage.

14. Earthwork for interim and final reclamation generally must be completed within 6 months of well completion or plugging (weather permitting).

~~15. Topsoil stored for a period greater than 90 days will not exceed piles of 3 feet in depth and will be seeded with a BLM approved seed mix in order to prevent wind and water erosion and to reduce the loss of microbial activity within the soil.~~

~~16. Re-seed all disturbed areas not needed for production with native species adapted to the site conditions and capable of providing protective soil cover within 6 months of the completion or plugging of the well. All seed must be certified weed-free. When practical, reseeding of disturbed areas should include the use of locally harvested seed from comparable areas in Wyoming and surrounding states.~~

Vegetation

Impacts Common to All Alternatives

Impacts to vegetation include long-term and short-term removal of vegetative communities, loss of habitat for wildlife, decreased forage production, and the possible introduction of invasive, non-native plant species.

Short-term impacts consist of temporary removal of vegetation as a result of construction activities from well pads, ancillary facilities, road, and pipelines. Long-term impacts include long term loss of vegetation associated with operation and maintenance activities of well pads and roads.

Indirect impacts may include vegetation loss from oil spills, dust emissions, and the introduction of noxious weeds and non-native plant species. The dust deposited on the plants may reduce plant vigor, productivity, and health. As a result of the introduction of noxious weeds, plant diversity and communities may change.

The extent of the impacts would depend on plant sensitivity, type and timing of project activities, acres of disturbance both long term and short term, and physical parameters.

No Action Alternative

Under the no action alternative, 969 acres would be disturbed in the short term (0.77% of project area) and 560 acres would be disturbed in the long term (0.45% of project area). The no action alternative yields the highest amount of acres disturbed. Consequently, the potential and extent of impacts to the vegetation would be the highest of the three alternatives.

Proposed Action Alternative

Under the proposed action, 242 acres would be disturbed in the short term (0.19% of project area) and 139 acres would be disturbed in the long term (0.11% of project area). The combination of lower number of well pad/locations and the co-location (on the same well pad/location) of some of the proposed wells, the proposed action yields less acres of disturbance when compared to the no action alternative. Consequently, the potential and extent of impacts to the vegetation would be approximately 75% less when compared to the no action alternative.

Agency Alternative

Under the agency alternative, 264 acres would be disturbed in the short term (0.21% of project area) and 152 acres would be disturbed in the long term (0.12% of project area). The agency alternative yields approximately the same amount of acres disturbed as the proposed action. Due to the co-location (on the same well pad/location) of up to four wells per well pad/location, the agency alternative yields the most consolidated footprint and the most shared acres of disturbance. Consequently, the potential and extent of impacts to the vegetation would be the same as the proposed action at the smallest development ratio (one well per well pad/location) and the lowest of the three alternatives at the largest development ratio (four wells per well pad/location) when compared to the no action alternative.

Mitigation Measures

Combined mitigation measures from soils and ecological sites, discussed previously and invasive, non-native species discussed below will be used for successful re-vegetation and reclamation of vegetation removal and disturbances.

Site-specific seed mixtures will be identified prior to commencing reclamation.

Invasive, Non-Native Species and Noxious Weeds

Impacts Common to All Alternatives

Invasive plants can create a host of environmental and other effects, most of which are harmful to native ecosystem processes. Variously referred to as exotic, nonnative, invasive, non-native species, and noxious, these plants affect native communities by displacing native vegetation, disrupting habitats, and becoming established and spreading over time.

Under all alternatives, the construction of new well locations would initiate disturbance of soils and vegetation. In turn, machinery could gradually bring non-native species to the area along newly developed access roads. All INPS would have a chance to establish after disturbance has occurred.

No Action Alternative

The no action alternative yields the highest amount of acres disturbed. Consequently, the potential and extent of impacts from the introduction of INPS would be the highest of the three alternatives.

Proposed Action Alternative

The combination of lower number of well pad/locations and the co-location (on the same well pad/location) of some of the proposed wells, the proposed action yields less acres of disturbance when compared to the no action alternative. Consequently, the potential and extent of impacts from the introduction of INPS would be approximately 75% less when compared to the no action alternative.

Agency Alternative

The agency alternative yields approximately the same amount of acres disturbed as the proposed action. Due to the co-location (on the same well pad/location) of up to four wells per well pad/location, the agency alternative yields the most consolidated footprint and the most shared acres of disturbance. Consequently, the potential and extent of impacts from the introduction of INPS would be the same as the proposed action at the smallest development ratio (one well per well pad/location) and the lowest of the three alternatives at the largest development ratio (four wells per well pad/location) when compared to the no action alternative.

Mitigation Measures

The operator shall provide a pesticide utilization proposal (PUP) and an integrated pest management plan (IPMP) as part of the complete APD package if any part of the project is located on BLM-administered surface. In the case of split estate, the operator shall include the IPMP within the surface use agreement with the private surface owner.

Fencing the well pads off from livestock grazing for two years after seeding and weed control will give the vegetation a chance to germinate and establish in the disturbed areas.

Seeding and INPS weed control as well as fencing of well pads to promote future native vegetative growth will improve the vegetative composition on the sites after disturbance.

~~Reclamation of newly developed access roads should also be completed and vehicle traffic kept out to prevent any future introduction of INPS~~.

All surface disturbance not utilized in the running surface of the road should have interim reclamation performed. All vehicle traffic should be kept to the running surface to prevent the transport of INPS.

Control methods for INPS include physical, biological, and chemical methods.

- Physical methods include mowing during the first season vegetation is established, prior to seed formation, and hand pulling weeds in small or new infestations.
- Biological methods include the use of domestic animals, or biological agents that have been approved by the authorized officer.
- Chemical methods include the use of approved herbicides applied in accordance with the PUP or the surface use agreement with the private surface owner.

Water Resources

Impacts Common to All Alternatives

Groundwater

Water for construction, drilling, and completion activities would be obtained from an approved source and permitted by the WSEO. The vertical portion of the oil and gas well construction is cased and cemented through potable water-bearing zones in compliance with WOGCC requirements. Therefore, no impacts should occur to groundwater quantity or quality that could affect any groundwater wells in the project area. The potential for spill from fuels or other contaminants that could affect groundwater quality would be minimized by implementing BMPs, the SPCC plan, and complying with other state and federal regulations.

On average between1,000 and 2,000 barrels of water are used to drill a well and between 20,000 and 80,000 barrels of water are used to frac a well. In contrast, other water uses in Converse County, as of 2005, were estimated at 6,100,000 barrels of water per day (USGS 2012). Other uses include irrigation, mining, thermoelectric, public supply, domestic, and industrial.

Surface Water and Wetlands

Potential impacts on surface water associated with the activities common to all alternatives include increased erosion and sedimentation in creeks and drainages. Sediment from soil erosion in disturbed areas could be transported via surface water flow into drainages. Surface waters would be most susceptible to sedimentation during construction, drilling, and completion activities, particularly when culverts are installed. The potential for spill from fuels or other contaminants that could affect surface water quality would be minimized by implementing BMPs, the SPCC plan, and complying with other state and federal regulations. The intensity of these impacts depend on several factors: slope aspect and gradient, susceptibility of the soil to erosion, degree, and extent of soil disturbance, and mitigation measures implemented.

No Action Alternative

Impacts to groundwater occur two ways: through actual water usage and injection into the ground. The no action alternative has the potential for 66 wells to be drilled.

Water acquired from an approved source would be used to drill and for injection into the ground to perform hydraulic fracturing of the wells. This alternative could use a range of between 1,386,000 and 5,412,000 barrels of water over the life of the project, approximately 0.2 to 0.9 days of combined other water uses existing in Converse County.

Impacts to surface water occur with surface disturbance. The no action alternative yields the highest amount of acres disturbed. Consequently, the potential and extent of impacts to surface water would be the highest of the three alternatives.

Proposed Action Alternative

Impacts to groundwater occur two ways: through actual water usage and injection into the ground. Under the proposed action, 21 wells on 18 well pads would be drilled.

Water acquired from an approved source would be used to drill and for injection into the ground to perform hydraulic fracturing of the wells. This alternative could use 441,000 to 1,722,000 barrels of water over the life of the project; approximately 0.1 to 0.3 days of combined other water uses existing in Converse County. The potential and extent of impacts to the groundwater would vary with the actual amount of water used as described in the range above but would be approximately 68% less than the no action alternative.

Given the combination of a lower number of well pad/locations and the co-location (on the same well pad/location) of some of the proposed wells, the proposed action would yield less acres of surface disturbance when compared to the no action alternative. Thus, the potential and extent of impacts to surface water would be approximately 75% less when compared to the no action alternative.

Agency Alternative

Impacts to groundwater occur two ways: through actual water usage and injection into the ground. The agency alternative would construct 18 well pads/locations with a range of 18 to 72 wells (one to four wells per pad/location).

Water would be acquired from an approved source and used to drill and for injection into the ground to perform hydraulic fracturing of the wells. This alternative could use a range of approximately 378,000 to 1,476,000 barrels of water at the smallest development ratio (one well per well pad/location) to 1,512,000 to 5,904,000 barrels of water at the largest development ratio (four wells per well pad/location) over the life of the project. Which is comparable to the ranges of approximately <0.1 to 0.2 and 0.2 to 1.0 day, respectively of combined other water uses existing in Converse County.

The potential and extent of impacts to the ground water would vary with the actual amount of water used but would be approximately 73% less when compared to the no action alternative and 15% less when compared to proposed action at the smallest development ratio (one well per well pad/location). At the largest development ratio (four wells per well pad/location), the impacts would be approximately 71% more when compared to the proposed action and 8% more when compared to the no action alternative.

The agency alternative yields approximately the same amount of acres disturbed as the proposed action. Due to the co-location (on the same well pad/location) of up to four wells per well pad/location, the agency alternative yields the most consolidated footprint and the most shared acres of disturbance. Consequently, the potential and extent of impacts to the surface water would be approximately the same as the proposed action at the smallest development ratio (one well per well pad/location) and the lowest of the three alternatives at the largest development ratio (four wells per well pad/location) when compared to the no action alternative.

Mitigation Measures

On BLM-authorized drilling activities, require use of pitless drilling technology where there is potential for adverse impact to surface water, groundwater, or soils.

Class 1 and class 2 waters – (WDEQ water quality standard): NSO within 500 feet and controlled surface use (CSU) from 500 feet to ¼-mile. Within the CSU area, use best available technology and (or) BMPs to minimize impacts. Wildlife and livestock

watering facilities and recreation facilities will be allowed when no other alternatives exist and only when they meet management objectives. Waters other than class 1 and class 2 will be considered case-by-case.

CSU within 500 feet of water wells, springs, or artesian and flowing wells.

All wells will have surface casing set and cemented to isolate the water bearing zones according to state and local agencies and the BLM authorized officer.

Evaluate the impacts and mitigate the adverse impacts of all proposed and existing oil- and gas-produced water discharge on stream channel and streambank stability on all BLM-administered lands.

To reduce the potential for sediment transport in surface water runoff, well pads and access roads would be located, engineered, and constructed to minimize sediment load of surface water runoff.

Road drainage crossings (culvert installations) would be of the typical dry creek drainage crossing type. Crossings would be designed so they would not cause siltation or accumulation of debris in the drainage crossing, nor would the roadbed block the drainages.

Erosion of drainage ditches by runoff water would be prevented by diverting surface water at frequent intervals by use of cutouts. Subsequent reclamation activities would substantially reduce surface exposure and therefore decrease long-term impacts on surface waters.

Additionally, best management practices and a SWPPP would be implemented to minimize these impacts. All of the proposed wells are included in the SWPPP and storm water permit.

A watershed analysis will be completed for each crossing to assess whether a culvert is needed and the proper sizing.

Wildlife, Special Status Species, and Threatened and Endangered Species

Impacts Common to All Alternatives

Removing and altering habitat, constructing standing structures, and the increased human presence associated with additional oil and gas activities would have a direct impact on large and small wildlife populations. Actions associated with these activities would temporarily eliminate approximately 264 acres of wildlife habitat, consisting of grasses, forbs, and shrubs. Herbaceous and browse forage, nesting, feeding, and security habitat would be lost. These habitat losses would be either short-term or long-term as defined below.

Short-term loss refers to disturbances that would be reclaimed immediately after exploration and development activities are completed. Loss or alteration of habitats in grass-shrub meadows and on grassy slopes would be considered short-term and would occur in conjunction with lease development.

Long-term loss would occur in areas that could not be returned to their original vegetative state within a reasonable period (three to five years), such as producing wells and access roads.

No Action Alternative

Under the no action alternative there would be 969 acres of wildlife habitat removed in the short-term and 560 acres of wildlife habitat removed in the long-term. The No Action alternative yields the highest amount of acres disturbed. Consequently, the potential and extent of impacts from the removal of wildlife habitat would be the highest of the three alternatives, creating the most habitat fragmentation and a moderate amount of disruptive activity.

Proposed Action Alternative

Under the proposed action there would be 242 acres of wildlife habitat removed in the short-term and 139 acres of wildlife habitat removed in the long-term. The combination of lower number of well pad/locations and the co-location (on the same well pad/location) of some of the proposed wells, the proposed action yields less acres of disturbance when compared to the no action alternative. Consequently, the potential and extent of impacts from the removal of wildlife habitat would be approximately 73% less when compared to the no action alternative, creating minimal habitat fragmentation and disruptive activity.

Agency Alternative

Under the agency alternative there would be 264 acres of wildlife habitat removed in the short-term and 152 acres in the long-term. The agency alternative yields approximately the same amount of acres disturbed as the proposed action. Due to the co-location (on the same well pad/location) of up to four wells per well pad/location, the agency alternative yields the most consolidated footprint and the most shared acres of disturbance. Consequently, the potential and extent of impacts from the removal of wildlife habitat would be the same as the proposed action at the smallest development ratio (one well per well pad/location) and the lowest of the three alternatives at the largest development ratio (four wells per well pad/location) when compared to the no action alternative.

The agency alternative would cause the greatest extent of disruptive activity at the largest development ratio (four wells per well pad/location). However, the disruptive activity and habitat fragmentation would be consolidated across the landscape.

Big Game Species

There are no crucial big game habitats within the project area. Rather than direct habitat loss, the greatest impact on big game populations would be from displacement of big game species from preferred habitats as a result of increased level(s) of human activity (including vehicular traffic) and associated noise. The extent of this displacement is difficult to predict considering that response to noise and human presence varies from species to species as well as among individuals of the same species. In some cases, wildlife may habituate to noise and human presence after initial exposure and begin to use areas that were formerly avoided. Numerous studies have examined the effects of human presence on big game species (Klein 1974; Irwin and Peek 1979; Ward and Cupal 1979; MacArthur et al. 1982; Brekke1985) and it is commonly presumed that these effects are detrimental to individual species. However, research on the relationship between displacement from preferred habitats and increased stress due to human harassment (both intentional and otherwise) on overall population dynamics has been inconclusive to date, particularly pertaining to oil/gas exploration and development activity.

In addition to the avoidance response, an increased human presence intensifies the potential for wildlife-human interactions ranging from harassment to poaching and increased legal harvest. Likewise, increased traffic on access roads could increase the potential for wildlife-vehicle collisions. These collisions frequently occur where roads traverse areas frequented by game.

Construction, drilling and completion activities within the project area would temporarily displace big game animals in the immediate vicinity (up to 0.5 miles) of such activities. However, once these intensive activities have been completed, most big game animals would become acclimated to the reduction in traffic and human activity and would continue to use suitable habitat in closer proximity to well pads and access road routes. Such habitat may not be used to the same extent as it was prior to disturbance. It could take 10 to 20 years for some reclaimed areas to attain pre-disturbance shrub conditions and vegetation diversity. However, once all production operations have been terminated, existing facilities abandoned and removed, reclamation and reseeding operations completed, and suitable vegetation has been re-established, big game animals would likely re-occupy all previously disturbed areas within the project area.

Raptor Species

A number of raptor species (e.g., golden eagle, ferruginous hawk, prairie falcon, red-tailed hawk, Swainson's hawk, and great-horned owl) seasonally occupy habitats found within the project area. Disturbance or loss of habitat would have a direct impact to raptors. The loss or alteration in habitat, reduction in prey base, and increased human disturbance can result in a reduced prey base for raptors, resulting in lower raptor densities.

Raptors breeding in or adjacent to the project area could abandon breeding territories, nest sites, lose eggs, or young because of construction and operation activities occurring during the breeding season (February 1 to July 31). Loss of an active nest site, incubating adults, eggs, or young would violate the MBTA and, in the case of the golden eagle, would violate the Bald and Golden Eagle Protection Act. Populations of raptors that occur within the project area could also be affected by the loss of active nest sites. Future nest sites and foraging habitat would be influenced by surface-disturbing activities and increased human presence within the project area. In some instances, raptors use structures associated with oil and gas development for nest construction. Though they are suitable nesting structures, they may not be optimal for nest success. At the time the APD is processed a comprehensive survey of raptor nests would be conducted.

Threatened and Endangered Species

Table 4.2 provides a listing of these species and their occurrence potential within the project area. A brief discussion of each specie, their habitat preferences, and occurrence potential follows.

Black-footed ferret *(Mustela nigripes)*. The black-footed ferret is a potential resident in prairie dog *(Cynomys sp.)* colonies throughout the state of Wyoming with a re-introduced population in the Shirley Basin area of northeastern Carbon County, Wyoming. Although prairie dog towns are present within the project area, there have been no documented occurrences or reintroductions; consequently, there will be *"No Effect"* to the black- footed ferret.

Colorado Butterfly Plant (*Gaura neomexicana* ssp*. coloradensis)*. The project area is located outside of the geographic range of this species. Therefore, there will be *"no effect"* to the Colorado butterfly plant.

Designated Critical Habitat for Colorado Butterfly Plant. There is no designated critical habitat for this species within the project area. Therefore, there will be *"no effect"* to designated critical habitat for the Colorado butterfly plant.

Ute ladies'-tresses *(Spiranthes diluvialis)*. There are no documented populations within the project area, and there is no documented potentially suitable habitat located within the project area. Therefore, there will be *"no effect"* to the Ute ladies tresses. At the time of APD processing consultation with the US Fish and Wildlife Service will be conducted if impacts will occur.

Blowout penstemon *(Penstemon haydenii)*. There are no known populations located within the project area, and there is no documented potentially suitable habitat located within the project area. Therefore, there will be *"no effect"* to the Blowout penstemon. At the time of APD processing consultation with the US Fish and Wildlife Service will be conducted if impacts will occur.

Prebles Meadow Jumping Mouse (*Zapus hudsonius preblei*). The project area is located outside of the geographic range of this species. Therefore, there will be *"no effect"* to the Prebles meadow jumping mouse.

Species Affected by North Platte River Water Depletions. Those five North Platte species identified earlier in chapter 3 (interior least tern, piping plover, pallid sturgeon, whooping crane, and western prairie fringed orchid*)* that may occur in the downstream riverine habitats of the North Platte River in Nebraska could be adversely affected by surface water depletions (consumption) in the North Platte River system resulting from project-related activities. Therefore, the proposed activities *"may affect* or is *likely to adversely affect"* downstream North Platte River species. At the time of APD processing consultation with the FWS will be conducted if water is obtained from a hydroloigically connected sub-basin to the North Platte River Watershed and exceeds 0.1 acre/feet.

Table 4.2. Occurrence Potential of Federally Listed Threatened and Endangered Species within the Project Area

Species		Federal Status[a]	Likely to Occur[b]
Common Name	**Scientific Name**		
MAMMALS			
Black-footed ferret	*Mustela nigripes*	E	X
Prebles meadow jumping mouse	*Zapus hudsonius preblei*	E	X
PLANTS			
Blowout penstemon	*Penstemon haydenii*	E	X
Ute ladies'-tresses	*Spiranthes diluvialis*	T	X
Colorado butterfly plant	*Gaura neomexicana* ssp. *Coloradensis*	T	X
NORTH PLATTE RIVER SPECIES			
Interior least tern	*Sterna antillarum*	E	X
Piping plover	*Charadrium melodus*	T	X
Whooping crane	*Grus Americana*	E	X
Pallid sturgeon	*Scaphirhynchus albus*	E	X
Western prairie fringed orchid	*Plantanthera praeclara*	T	X

[a] [b] Federal status: E = listed as federally endangered. T = listed as federally threatened.
Species occurrence: X = unlikely; there has been no recent historical record of the species' occurrence in the project area; probability of encountering the species during project-related activity is very unlikely.

BLM Sensitive Species

Bald Eagle and Ferruginous Hawk. Impacts to bald eagles and ferruginous hawks would be the same as described above in this section under Raptor Species.

Black-tailed Prairie Dog. Impacts to prairie dog species could include direct mortalities of individuals, as a result of crushing from construction activities, vehicles, and equipment. Additional impacts could result from increased habitat fragmentation and human presence and noise. Construction activities would not be anticipated to permanently alter black-tailed prairie dog colonies within the project area. Habitat disturbance could actually encourage future colonization in the short-term, based on the availability of soft, permeable soils that would occur within the disturbed areas subsequent to the project construction.

Burrowing Owl. The proposed activities could result in disturbances to breeding, nesting, and fledgling success. Proposed oil and gas activities would further reduce the amount of suitable habitat for burrowing owls. Well drilling and other human activities (both directly and indirectly associated with these projects) would incrementally reduce the productivity of the habitats affected and increase the amount of human presence within the project area. Indirect negative impacts could include displacement from foraging areas and reduction of prey species. In general, the severity of the cumulative effects would depend on factors such as the sensitivity of the species, seasonal intensity of use, type of project activity, and physical parameters (e.g., topography, forage, and habitat availability). Overall, the proposed activities may affect individual burrowing owls but would not likely result in a trend towards federal listing of the species.

Greater Sage-grouse. Impacts to Greater sage-grouse would result in the short- to long-term (depending on the ecological site characteristics) loss of potentially suitable breeding habitats. Impacts to Greater sage-grouse would include increased habitat fragmentation from increased noise levels and human presence, dispersal of noxious and invasive weed species, and dust from unpaved road traffic. An increase in noxious and invasive weeds reduces habitat quality by eliminating important native species of plants that provide both cover and food for Greater sage-grouse. Project-related impacts also could lead to increased vehicle collision potential as well as increased predation by raptors, corvids, and coyotes because of decreased sagebrush vegetation cover associated with surface-disturbing activities.

Mountain Plover. The proposed activities could result in disturbances to breeding, nesting, and fledgling success of mountain plovers. Impacts to mountain plover include the direct loss of grassland-low shrub habitat suitable for reproduction and foraging, and timing of surface-disturbing actions and increased human presence during sensitive breeding and nesting periods. These impacts could cause individual breeding pairs to abandon the area and/or nest and young, choosing other areas. Indirect impacts could include increased inter- and intra-species competition for suitable breeding and foraging sites elsewhere within the grassland habitats in the project area and surrounding areas. Suitable mountain plover reproduction and foraging habitat occurs within the project area.

Swift Fox. Direct and indirect impacts to swift fox would include wildlife mortalities or displacement related to construction and operation; habitat loss, alteration, and

fragmentation; and increased levels of noise, activity, and human presence. Project construction and operation on previously undisturbed lands would result in the loss of potential habitat, until reclamation was completed and vegetation re-established. Impacts also could include temporary displacement of swift fox from areas with surface disturbance, due to the short-term and long-term loss of vegetation.

BLM Sensitive Migratory Birds

Impacts to Bairds sparrow, Brewers sparrow, loggerhead shrike, long-billed curlew, sage sparrow, and sage thrasher generally would be the same as described in the "Migratory Bird Species" section below.

Impacts specific to Bairds sparrow, Brewers sparrow, loggerhead shrike, long-billed curlew, sage sparrow, and sage thrasher, if present, would occur as a result of the short-term and long-term loss of potentially suitable upland habitats within the project area. Additional impacts such as displacement and avoidance also would result from increased noise and human presence associated with construction and operation activities. However, due to the amount of suitable habitat in the project vicinity, impacts would be minor.

Migratory Bird Species

Numerous species of migratory birds, including passerines, may forage or nest in or near the project area. Under the proposed activities, impacts to migratory birds in the project area would be similar for all migratory birds but would vary depending on loss of habitat types and species' or individual birds' sensitivities to disturbance. For the purposes of analysis in this EA, impacts to migratory birds within the project area are discussed together. Approximately 936 acres of vegetation used by migratory birds for nesting and foraging habitats would experience short-term disturbance under the proposed action and 539 acres of long-term disturbance. Successful interim and final reclamation, in conjunction with weed control efforts, would help to restore the needed forage and cover types required by migratory birds over time.

Other impacts to migratory birds associated with the implementation of the proposed activities would depend on seasonal timing of construction, drilling, and completion activities. If these activities were conducted in the late fall, many of the migratory species would have left the project area for southern wintering grounds. Surface disturbance, visual and noise impacts during this time would not affect most individual birds or nesting locations. However, if such activities were to occur during the spring or summer months, this could result in displacement of nesting pairs from establishing nests or cause nest abandonment. Associated noise and increased human presence could cause displacement for foraging and nesting habitats.

Mitigation Measures and Monitoring and/or Compliance

In order to minimize the overall impacts to wildlife within the project area that could

result from additional oil/gas exploration and development activities associated with the proposed activities, the following mitigation measures ~~are recommended~~ will be required on a case by case basis as resource conditions dictate. The project area is located in both the Casper Field Office and the Newcastle Field Office administrative areas; therefore, the mitigation measures will be categorized by field office.

Casper Field Office

Greater Sage-grouse. Surface-disturbing activities are prohibited within one ¼- mile radius of occupied sage-grouse leks. Disruptive activities are restricted within ¼-mile radius of occupied or undetermined sage-grouse leks from 6 pm to 8 am from March 1 to May 15.

Surface disturbing and/or disruptive activities are prohibited or restricted from March 1to July 15 in sage-grouse nesting and early brood-rearing habitat within 2 miles of any occupied age-grouse lek.

Raptors. Surface-disturbing and/or disruptive activities are restricted from February 1 to July 31 or until the chicks have fledged within ½ mile radius of all raptor nests. A ¼-mile radius will be used for the following species: red-tailed hawk, Swainson's hawk, American kestrel, osprey, great horned owl, long-eared owl, Northern saw-whet owl, common barn owl, Western screech owl

Overhead power lines will be designed, constructed, and installed in accordance with the standards outlined in *Suggested Practices for Raptor Protection on Power Lines: the State of the Art in 2006* (APLIC 2006).

Mountain Plover. Surface-disturbing and/or disruptive activities are restricted from April 10 to July 10 in all suitable mountain plover breeding or nesting habitat within ¼-mile of the proposed activities.

Prairie Dogs. Surface-disturbing and disruptive activities should be designed in a manner that avoids prairie dog towns and complexes (CSU). Where this is impractical, the disturbance should be located in a manner where it will have the least amount of impact to prairie dogs.

Bald Eagle. ~~Surface development or use is prohibited (NSO) on all public lands and minerals within a 1 mile radius of known or discovered bald eagle nests.~~ Prohibit surface development in an area from 1/2- to 1-mile of known or discovered bald eagle nests. The specific distance and dimensions of the area on which surface development will be prohibited will be determined on a case-by-case basis.

Surface development or use is prohibited (NSO) on all public lands and minerals within designated bald and golden eagle winter roosts. Disruptive activities will be restricted from November 1 to March 31 for habitat improvement projects.

Threatened, Endangered, and Special Status Species. Surface development or use is prohibited (NSO) on all designated critical habitat for threatened or endangered species. Areas known or suspected to contain essential habitat for threatened and endangered species and/or special status species will be subject to a CSU restriction, requiring the proponent to conduct inventories or studies to verify the presence or absence of special status species.

Newcastle Field Office

Greater Sage-grouse. Avoid surface disturbance or occupancy within ¼ mile of the perimeter of occupied sage-grouse leks. Avoid human activity between 8 PM and 8 AM from March 1 – May 15 within ¼ mile of the perimeter of occupied sage-grouse leks.

Avoid surface disturbing and disruptive activities in suitable sage-grouse nesting and early brood rearing habitat within two miles of an occupied lek or in identified sage-grouse nesting and early brood rearing habitat outside the 2-mile buffer from March 15 - July 15.

Avoid disturbance and disruptive activities in sage-grouse winter habitat from November 15 – March 14.

Raptors. To protect raptors during the nesting season, disruptive activities generally will not be allowed from February 1 to July 31.

Mountain Plover. Surface disturbing and/or disruptive activities are restricted from April 10 to July 10 in all suitable Mountain plover breeding or nesting habitat within ¼ mile of the proposed activities.

Prairie Dogs. The BLM will evaluate the utility of locating projects at least 50 meters from prairie dog towns.

The BLM will ensure that black-tailed prairie dog conservation is addressed on all authorization evaluations and other environmental assessments.

Ute ladies'-tresses. Surveys for the Ute ladies'-tresses orchid will be conducted in potential habitat according to the current FWS survey guidelines within both special management areas. The surveys will be conducted for three consecutive years in potential orchid habitat. If the first survey shows that suitable habitat doesn't exist, even though streams occur in an area to be impacted, these areas may be dropped from further surveys. In suitable orchid habitat in these special management areas, current activities will cease and the authorization of new activities will be held until surveys are completed.

Any activities occurring in riparian or wetland areas will be surveyed and water quality monitored as a safeguard to protect potential Ute ladies'-tresses

habitat.

The BLM will apply a COA on all APDs within areas containing known populations of Ute ladies'-tresses orchid, prohibiting all surface-disturbing activities.

Threatened and Endangered and Special Status Species. The BLM will require an analysis of effects to all resources, including special status species during activity planning. Coordination between BLM planners, BLM resource specialists (including biologists), and activity proponents during the activity planning and site specific implementation stages will be required to exchange information about threatened and endangered species locations, any necessary activity constraints, and conservation measures.

When project proposals are received in potential endangered, threatened, proposed, or candidate species habitat, the BLM shall coordinate with the FWS at the earliest possible date so that the FWS can advise on project design. This should minimize the need to redesign projects later to include conservation measures, determined as appropriate by the FWS. Currently, project proposals are reviewed by regional federal ESA streamlining "level 1" teams, which include a FWS member.

The BLM requires clearances and/or surveys for authorized activities in areas known or suspected to be essential habitat for animals and plants classified as threatened, endangered, proposed, candidate, or other special status species. These clearances and surveys will be done in accordance with BLM and FWS guidelines, as appropriate, to verify the presence or absence of these species. All clearances shall be performed prior to activity implementation.

In the event that a T&E species is identified during a project clearance or survey, the project or management action will include protection requirements for the species and its habitat. These protective requirements may include project relocation, modification, or postponement, if necessary.

Hazardous or Solid Wastes

Impacts Common to All Alternatives

No differences are anticipated in how hazardous wastes are addressed between the No Action and action alternatives and therefore will not be addressed individually.

Mitigation Measures

In the event that hazardous or extremely hazardous materials or substances, as defined in 40 CFR 355, would be used, produced, stored, transported, or left on or in the vicinity of the operators project area, the operator shall comply with all rules and regulations including but not limited to reportable quantities of stored materials and the reporting of accidental release as set forth in 40 CFP 355. The operator will follow all applicable

federal, state, county or local laws and regulations if any chemicals or proprietary blends that are subject to the SARA are used during the drilling process or are stored on any site. All hazardous substances and commercial preparations would be handled in an appropriate manner to minimize the potential for leaks or spills. The operator shall develop and maintain a SPCC plan for each well site. Storage facilities and tanks shall use secondary containment structures of sufficient capacity to contain, at a minimum, the entire contents of the largest tank with sufficient freeboard to contain precipitation after the well goes into production.

Portable chemical toilets will be provided for the use of workers. Toilets will be pumped as required and waste disposed of by a commercial operator.

Trash and debris will be picked up daily and deposited in an appropriate container. After removal of the drilling equipment, the container will be removed from the site.

Public Health and Safety

Impacts Common to All Alternatives

Public health and safety is addressed in operator-specific (SPCC) plans and aboveground storage tanks (ASTs), as mandated by both federal and state regulations through the EPA and the WDEQ. Federal regulations for SPCC are at 40 CFR 112; Wyoming AST program administration is located on the web at http://deq.state.wy.us/shwd/stp/.

There are no differences anticipated in how public health and safety is addressed between the alternatives. Therefore, this will not be addressed individually.

Mitigation Measures

All operators will have an emergency/contingency plan that address public health and safety in the event of an accident or unforeseen circumstance warranting immediate response.

CUMULATIVE EFFECTS

According to guidance from the NEPA Handbook (H-1790-1), “Cumulative effects considers past, present, and reasonably foreseeable future actions that would affect the resource of concern within the geographic scope and the timeframe of the analysis. In your analysis, you must consider other BLM actions, other Federal actions, and non-Federal (including private) actions (40 CFR 1508.7).” Also, “Reasonably foreseeable future actions are those for which there are existing decisions, funding, formal proposals, or which are highly probable, based on known opportunities or trends.”

For the purpose of this analysis, the existing oil and gas development within the project area has been separated into two categories: prior to the ROD/RMP (December 2007)

and after the ROD/RMP (December 2007). This distinction will help distinguish between existing and new projections calculated in the ROD/RMP.

The past and present oil and gas well status for the project area is depicted in table 4.3.

Table 4.3. Past and Present Oil and Gas Well Status

Oil and Gas Well Status	Prior to ROD/RMP (December 2007)	After the ROD/RMP (December 2007)	Totals Wells
OVERALL			
Plugged and abandoned wells	70	0	70
Operational wells	81	7	88
Total existing wells	**151**	**7**	**158**
* Spud date; as of February 15, 2012			

The reasonably foreseeable future actions (RFFA) would typically include continued livestock grazing and range improvements, oil and gas development and associated infrastructure, and rights-of-ways. Currently there are no known federal or non-federal applications for future development within the project area, except for the proposed activities. It is assumed oil and gas development will continue for the private and state owned minerals within the project area.

Based on the information drawn on the well pad diagram/ layout accompanying the NOSs and APDs there are future wells identified for the majority of the well pads/ locations, even though they have not been specifically applied for at this time. It is highly probable, based on known opportunities or trends that those future wells will be submitted under a separate NOS or APD at a later date. Although we have information about them, it would be speculative to include them as part of the RFFA, as they are not formal proposals at this time. However, it does support the agency alternative analysis of up to four wells per well pad/ location.

The past, present and RFFA combined within the East Converse project area only account for an additional seven wells. The increased increment of those seven wells across all the alternatives would marginally increase the impacts of each resource and will not be analyzed in a separate cumulative impacts section specific to this project area. However, they will be included in table 4.4.

Table 4.4 combines the three project areas and all the past, present, and RFFA for a more comprehensive incremental effects analysis.

COMBINED CUMULATIVE IMPACTS FOR SPEARHEAD RANCH, HIGHLAND LOOP ROAD, AND EAST CONVERSE PROJECT AREAS

In response to individual NOSs and APDs submitted to the CFO for approval, the submissions were plotted on a map using geographic information system (GIS). Three

distinct geographical groupings emerged within Converse County. Map 2 shows each project area considered for the combined cumulative impacts section.

It was recognized that consideration of the combined proposed actions, alternatives and cumulative impacts of the three project areas would need to be analyzed. In an effort to include all the alternatives and all the project areas, the BLM has added a combined cumulative impacts analysis to each document that takes all three document details into consideration. See the combined cumulative impacts section in Chapter 4, for incremental resource impacts of the combined project areas.

Below are the combined actions and potential for impacts for all three-project areas into one combined cumulative effects table.

No Action Alternative

A combined total for the potential of 383 wells from the following EAs:

Spearhead EA = 154;
Highland EA = 163; and
East Converse EA = 66.

Proposed Action Alternative

A combined total of 111 well pads/ locations with 140 wells from the following EAs:

Spearhead EA = 56 well pads/ locations with 79 wells;
Highland EA = 37well pads/ locations with 40 wells; and
East Converse EA = 18 well pads/ locations with 21 wells.

Agency Alternative

A combined total of 111 well pads/ locations with a range of 111 to 444 wells from the following EAs:

Spearhead EA = 56 well pads/ locations with a range of 56 to 224 wells;
Highland EA = 37 well pads/ locations with a range of 37 to 148 wells; and
East Converse EA = 18 well pads/ locations with a range of 18 to 72 wells.

Past and Present Actions

Combining all three project areas, there are approximately 904 existing oil and gas wells, including Federal, state and fee (private). Of those, 419 wells (46%) are plugged and abandoned and 485 wells (54%) are considered operational. Of the 485 operational wells, only 26 wells (5%) were after the ROD/RMP with 11 of those federal wells.

Reasonably Foreseeable Future Actions

The RFFA are in addition to the 140 wells on 111 well pads/locations described in the proposed action and consists of 112 new or pending well applications within the combined project areas. The 112 new or pending well applications involve the following mineral estates: 63 federal, 21 state, and 28 private (fee).

The BLM projected reasonable foreseeable action (RFA) scenario for each resource program under each alternative in Appendix M of the Proposed Resource Management Plan and Final Environmental Impact Statement (FEIS) for the Casper Field Office Planning Area (BLM 2007). For oil and gas, the prediction was referred to as an RFD scenario. The projections for oil and gas wells were considered in terms of number and types of wells, whether they were federal or non-federal wells, and the associated acres of disturbance created by the wells both short and long-term.

Acres of disturbance calculations for the past and present and RFFA were calculated based on projections for new wells as stated in Table 23 of the RFD scenario in the ROD/RMP.

Table 4.4 Combined Cumulative Effects for Spearhead Ranch, Highland Loop Road, and East Converse EAs

Resource	Cumulative Increment	NO ACTION ALTERNATIVE Combined total = 383	PROPOSED ACTION Combined total = 111 well pads/ locations with 140 wells	AGENCY ALTERNATIVE Combined total = 111 well pads/locations with a range of 111 to 444 wells
Air Resources	*Past and Present (+)*	Based on the assumptions analyzed within the EAs, the 26 existing wells could account for an increase of the total wells (39,500) included in air quality analysis by 0.07%. Assuming steady production and emission venting these wells could account for the production of 0.005 mmt GHG emissions annually.		
	(RFFA) (+)	The 112 future wells would represent an increase of 0.28% to the total wells (39,500) included in the air quality analysis and assuming steady production and emission venting these wells could produce 0.021 mmt of GHG emissions annually.		
	Incremental Effect of Alternatives (+)	This alternative has the potential for a combined 383 new federal wells across the three-project areas. The 383 wells would represent an increase of 0.97% to the total wells (39,500) included in the air quality analysis. Assuming steady production and emission venting these wells could produce 0.073 mmt of GHG emissions annually.	Under this alternative, a combined 140 new federal wells would be constructed on 111 well pads/locations across three project areas. The 140 wells would represent an increase of 0.35% to the total wells (39,500) included in the air quality analysis. Assuming steady production and emission venting these wells could produce 0.027 mmt of GHG emissions annually. Given the combination of lower number of well pads/locations and the co-location (on the same well pad/location) of some of the proposed wells, this alternative would have approximately 60% less GHG emissions when compared to the no action alternative. This alternative has the potential to reduce the miles of pipeline as well as the number of production and storage facilities required moderately reducing the estimated GHG emissions because of co-location.	Under this alternative, a combined range of 111 to 444 new federal wells would be constructed across three project areas. The wells would represent increases in the range of between 0.28% and 1.12% for the total wells (39,500) included in the air quality analysis. Assuming steady production and emission venting these wells could produce a range of between 0.021 and 0.085 mmt of GHG emissions annually. Due to the co-location (on the same well pad/location) of up to four wells per well pad/location, this alternative yields the most consolidated footprint and the most shared acres of disturbance. This alternative would have approximately 22% less GHG emissions when compared to the proposed action and approximately 71% less GHG emissions when compared to the no action alternative at the smallest development ratio (one well per well pad/location). At the largest development ratio (four wells per well pad/location), the agency alternative would have approximately 14% more GHG emissions than the no action alternative and 68% more GHG emissions than the proposed action. However, the agency alternative has the greatest potential to reduce the miles of

Resource	Cumulative Increment	NO ACTION ALTERNATIVE Combined total = 383	PROPOSED ACTION Combined total = 111 well pads/ locations with 140 wells	AGENCY ALTERNATIVE Combined total = 111 well pads/locations with a range of 111 to 444 wells
				pipeline as well as the number of production and storage facilities required; therefore, substantially reducing the estimated GHG emissions as a result of co-location when compared to the no action alternative and the proposed action.
	Total by Alternative (=)	There would be an estimated 1.32% increase to the total wells included in the air quality analysis and a 0.100% increase in GHG emissions for a combined total of 521 wells within the three project areas.	There would be an estimated 0.70% increase to the total wells included in the air quality analysis and a 0.053% increase in GHG emissions for a combined total of 278 wells located on 249 well pads/locations within the three project areas.	There would be an estimated range of between 0.63% increase to the total wells included in the air quality analysis and a 0.048% increase in GHG emissions for the smallest development ratio (one well per well pad/location) (249 wells) and a 1.47% increase to the total wells included in air quality analysis and a 0.112% increase in GHG emissions for the largest development ratio (four wells per pad/location) (582 wells) within the three project areas.

Resource	Cumulative Increment	NO ACTION ALTERNATIVE Combined total = 383	PROPOSED ACTION Combined total = 111 well pads/ locations with 140 wells	AGENCY ALTERNATIVE Combined total = 111 well pads/locations with a range of 111 to 444 wells
Range Management	*Past and Present (+)*	Based on the assumptions analyzed within the EAs, the 26 existing wells could account for a reduction of approximately 55 AUMs.		
	(RFFA) (+)	The 112 future wells would reduce approximately 241 AUMS.		
	Incremental Effect of Alternatives (+)	This alternative would reduce approximately 1,490.63 AUMs (3.93%) prior to reclamation with an overall reduction of approximately 854 AUMs (2.25%) of the total AUMs in the combined project areas throughout the life of the project. This alternative yields the highest amount of acres disturbed and would reduce the largest amount of AUMs. Consequently, the potential and extent of impacts to livestock grazing and range management would be the highest of the three alternatives.	This alternative would reduce approximately 414.59 AUMs (1.10%) prior to reclamation with an overall reduction of approximately 237.78 AUMs (0.63%) of the total AUMs in the combined project areas throughout the life of the project. Given the combination of lower number of well pads/locations and the co-location (on the same well pad/location) of some of the proposed wells, the proposed action yields less acres of disturbance when compared to the no action alternative. Consequently, the potential and extent of impacts to livestock grazing and range manage-ment would be approximately 72% less when compared to the no action alternative.	This alternative would reduce approximately 423.79 AUMs (1.12%) prior to reclamation with an overall reduction of approximately 240.97 AUMs (0.64%) of the total AUMs in the combined project areas throughout the life of the project. The agency alternative yields approximately the same amount of acres disturbed as the proposed action. Due to the co-location (on the same well pad/location) of up to 4 wells per well pad/location, the agency alternative yields the most consolidated footprint and the most shared acres of disturbance. Consequently, the potential and extent of impacts to the soils and ecological sites would be the same as the proposed action at the smallest development ratio (1 well per well pad/location) and the lowest of the three alternatives at the largest development ratio (4 wells per well pad/location) when compared to the no action alternative.
	Total by Alternative (=)	Of the 37,831 combined AUMs within the three project areas, there would be an estimated long-term reduction of 1,150 AUMs (3.04%).	Of the 37,831 combined AUMs within the three project areas, there would be an estimated long-term reduction of 534 AUMs (1.41%).	Of the 37,831 combined AUMs within the three project areas, there would be an estimated long-term reduction of 537 AUMs (1.42%).

Resource	Cumulative Increment	NO ACTION ALTERNATIVE Combined total = 383	PROPOSED ACTION Combined total = 111 well pads/ locations with 140 wells	AGENCY ALTERNATIVE Combined total = 111 well pads/locations with a range of 111 to 444 wells
Soils and Ecological Sites	*Past and Present (+)*	Based on the assumptions analyzed within the EAs, the 26 existing wells could account for approximately 91 acres of the existing surface disturbance (long-term) within the three project areas.		
	(RFFA) (+)	The 112 future wells would increase the long-term surface disturbance by approximately 392 acres.		
	Incremental Effect of Alternatives (+)	The short-term combined surface disturbance for construction, drilling, completion, and production would yield an approximate total 7,816.65 acres of disturbance prior to reclamation. The long-term combined surface disturbance with consideration for reclamation would yield a total of 4,477.5 acres of disturbance over the life of the project. This alternative yields the highest amount of acres disturbed. Consequently, the potential and extent of impacts to the soils and ecological sites would be the highest of the three alternatives.	The short-term combined surface disturbance for construction, drilling, completion, and production would yield an approximate total of 2,118.33 acres of disturbance prior to reclamation. The long-term combined surface disturbance with consideration for reclamation would yield a total of 1,212.77 acres of disturbance over the life of the project. The combination of lower number of well pads/locations and the co-location (on the same well pad/location) of some of the proposed wells, the proposed action yields less acres of disturbance when compared to the no action alternative. Consequently, the potential and extent of impacts to the soils and ecological sites would be approximately 73% less when compared to the no action alternative.	The short-term combined surface disturbance for construction, drilling, completion, and production would yield an approximate total of 2,168.51 acres of disturbance prior to reclamation. The long-term combined surface disturbance with consideration for reclamation would yield a total of 1,244.77 acres of disturbance over the life of the project. This alternative yields approximately the same amount of acres disturbed as the proposed action. Due to the co-location (on the same well pad/location) of up to 4 wells per well pad/location the agency alternative yields the most consolidated footprint and the most shared acres of disturbance. Consequently, the potential and extent of impacts to the soils and ecological sites would be the same as the proposed action at the smallest development ratio (1 well per well pad/location) and the lowest of the three alternatives at the largest development ratio (4 wells per well pad/location) when compared to the no action alternative.

Resource	Cumulative Increment	NO ACTION ALTERNATIVE Combined total = 383	PROPOSED ACTION Combined total = 111 well pads/ locations with 140 wells	AGENCY ALTERNATIVE Combined total = 111 well pads/locations with a range of 111 to 444 wells
	Total by Alternative (=)	Of the 751,688 combined acres within the three project areas, there would be an estimated long-term surface disturbance of 4,961 acres (0.66%).	Of the 751,688 combined acres within the three project areas, there would be an estimated long-term surface disturbance of 1,696 acres (0.23%).	Of the 751,688 combined acres within the three project areas, there would be an estimated long-term surface disturbance of 1,728 acres (0.23%).

Resource	Cumulative Increment	NO ACTION ALTERNATIVE Combined total = 383	PROPOSED ACTION Combined total = 111 well pads/ locations with 140 wells	AGENCY ALTERNATIVE Combined total = 111 well pads/locations with a range of 111 to 444 wells
Vegetation	*Past and Present (+)*	Based on the assumptions analyzed within the EAs, the 26 existing wells could account for approximately 91 acres of the existing surface disturbance (long-term) and subsequent removal of vegetation within the three project areas.		
	(RFFA) (+)	The 112 future wells would increase the long-term surface disturbance and subsequent removal of vegetation by approximately 392 acres.		
	Incremental Effect of Alternatives (+)	Under this alternative, there would be approximately 7,815 acres of short-term disturbance (1.04%) of the project area and 4,465 acres of long-term disturbance (0.60%) of the combined project areas. Impacts to vegetation occur during surface disturbance when the vegetation is damaged or removed. The no action alternative yields the highest amount of acres disturbed. Consequently, the potential and extent of impacts to the vegetation would be the highest of the three alternatives.	Under this alternative, there would be approximately 2,116 acres of short-term disturbance (0.28%) of project area and 1,211 acres of long-term disturbance (0.16%) of the combined project areas. Impacts to vegetation occur during surface disturbance when the vegetation is damaged or removed. The combination of lower number of well pads/locations and the co-location (on the same well pad/location) of some of the proposed wells, the proposed action yields less acres of disturbance when compared to the no action alternative. Consequently, the potential and extent of impacts to the vegetation would be approximately 73% less when compared to the no action alternative.	Under the agency alternative, there would be approximately 2,169 acres (0.29%) of short-term disturbance and 1,243 acres of long-term disturbance (0.17%) of the combined project areas. Impacts to vegetation occur during surface disturbance when the vegetation is damaged or removed. This alternative yields approximately the same amount of acres disturbed as the proposed action. Due to the co-location (on the same well pad/location) of up to 4 wells per well pad/location the agency alternative yields the most consolidated footprint and the most shared acres of disturbance. Consequently, the potential and extent of impacts to the vegetation would be the same as the proposed action at the smallest development ratio (1 well per well pad/location) and the lowest of the three alternatives at the largest development ratio (4 wells per well pad/location) when compared to the no action alternative.
	Total by Alternative (=)	Of the 751,688 combined acres within the three project areas, there would be an estimated long-term surface disturbance of 4,961 acres (0.66%).	Of the 751,688 combined acres within the three project areas, there would be an estimated long-term surface disturbance of 1,696 acres (0.23%).	Of the 751,688 combined acres within the three project areas, there would be an estimated long-term surface disturbance of 1,728 acres (0.23%).

Resource	Cumulative Increment	NO ACTION ALTERNATIVE Combined total = 383	PROPOSED ACTION Combined total = 111 well pads/ locations with 140 wells	AGENCY ALTERNATIVE Combined total = 111 well pads/locations with a range of 111 to 444 wells
Invasive, Non-Native Species	*Past and Present (+)*	Based on the assumptions analyzed within the EAs, the 26 existing wells could account for approximately 91 acres of the existing surface disturbance (long-term) within the three project areas		
	(RFFA) (+)	The 112 future wells would increase the long-term surface disturbance and subsequent introduction of INPS by approximately 392 acres.		
	Incremental Effect of Alternatives (+)	Introduction of INPS occurs with surface disturbance. This alternative yields the highest amount of acres disturbed. Consequently, the potential and extent of impacts from the introduction of INPS would be the highest of the three alternatives	Introduction of INPS occurs with surface disturbance. The combination of lower number of well pads/locations and the co-location (on the same well pad/location) of some of the proposed wells, this alternative yields less acres of disturbance when compared to the no action alternative. Consequently, the potential and extent of impacts from the introduction of INPS would be approximately 73% less when compared to the no action alternative.	Introduction of INPS occurs with surface disturbance. This alternative yields approximately the same amount of acres disturbed as the proposed action. Due to the co-location (on the same well pad/location) of up to 4 wells per well pad/location, this alternative yields the most consolidated footprint and the most shared acres of disturbance. Consequently, the potential and extent of impacts from the introduction of INPS would be the same as the proposed action at the smallest development ratio (1 well per well pad/location) and the lowest of the three alternatives at the largest development ratio (4 wells per well pad/location) when compared to the no action alternative.
	Total by Alternative (=)	Of the 751,688 combined acres within the three project areas, there would be an estimated long-term surface disturbance of 4,961 acres (0.66%).	Of the 751,688 combined acres within the three project areas, there would be an estimated long-term surface disturbance of 1,696 acres (0.23%).	Of the 751,688 combined acres within the three project areas, there would be an estimated long-term surface disturbance of 1,728 acres (0.23%).

Resource	Cumulative Increment	NO ACTION ALTERNATIVE Combined total = 383	PROPOSED ACTION Combined total = 111 well pads/ locations with 140 wells	AGENCY ALTERNATIVE Combined total = 111 well pads/locations with a range of 111 to 444 wells
Water Resources	*Past and Present (+)*	Based on the assumptions analyzed within the EAs, the 26 existing wells could account for current water consumption of approximately 546,000 to 2,132,000 barrels of water (long-term), comparable to 0.090 to 0.35 days of Converse County's combined water uses.		
	(RFFA) (+)	The 112 future wells would increase the long-term water usage by a range of approximately 2,352,000 to 9,184,000 barrels of water, comparable to 0.39 to 1.51 days of Converse County's combined water uses.		
	Incremental Effect of Alternatives (+)	Impacts to groundwater occur two ways: through actual water usage and injection into the ground. This alternative would use a range of between approximately 8,043,000 and 31,406,000 barrels of water for 383 wells over the life of the project. This water usage is comparable to 1.3 to 5.1 days of combined water uses throughout Converse County. Impacts to surface water occur with surface disturbance. The no action alternative yields the highest amount of acres disturbed. Consequently, the potential and extent of impacts to surface water would be the highest of the three alternatives.	Impacts to groundwater occur two ways: through actual water usage and injection into the ground. This alternative would use a range of between approximately 2,904,000 and 11,480,000 barrels of water for 140 wells over the life of the project. This water usage is comparable to 0.48 to 1.88 days of combined water uses throughout Converse County. The potential and extent of impacts to the groundwater would vary with the actual amount of water used as described in the range above but would be approximately 63% less than the no action alternative. The combination of lower number of well pad/locations and the co-location (on the same well pad/location) of some of the proposed wells, the proposed action yields less acres of surface disturbance when compared to the no action	Impacts to groundwater occur two ways: through actual water usage and injection into the ground. This alternative would use a range of between approximately 2,331,000 and 9,102,000 barrels of water for 111 wells to between 9,324,000 and 36,408,000 barrels of water for 444 wells over the life of the project. This water usage is comparable to 0.38 and 1.49 to 1.53 and 6.0 days of combined water uses throughout Converse County. The potential and extent of impacts to the groundwater would vary with the actual amount of water used but would be approximately 71% less when compared to the no action alternative and 31% less when compared to proposed action at the smallest development ratio (one well per well pad/location). At the largest development ratio (four wells per well pad/location) the impacts would be approximately 14% more than the no action alternative and 68% more than the proposed action. The agency alternative yields approximately the same amount of acres disturbed as the proposed action. Due to the co-location (on the same well pad/location) of up to four wells per well pad/location, this alternative yields the most consolidated footprint and

Resource	Cumulative Increment	NO ACTION ALTERNATIVE Combined total = 383	PROPOSED ACTION Combined total = 111 well pads/ locations with 140 wells	AGENCY ALTERNATIVE Combined total = 111 well pads/locations with a range of 111 to 444 wells
			alternative. Consequently, the potential and extent of impacts to surface water would be approximately 73% less when compared to the no action alternative.	the most shared acres of disturbance. Consequently, the potential and extent of impacts to the surface water would be approximately the same as the proposed action at the smallest development ratio (one well per well pad/location) and the lowest of the three alternatives at the largest development ratio (four wells per well pad location) when compared to the no action alternative.
	Total by Alternative (=)	An estimated range of between 10,941,000 and 42,722,000 barrels of water would be used long-term for 521 wells. Usage is comparable to 1.79 to 7 days of Converse County combined water uses.	An estimated range of between 5,802,000 and 22,796,000 barrels of water would be used long-term for 278 wells. Usage is comparable to 0.95 to 3.74 days of Converse County combined water uses.	An estimated range of between 5,229,000 and 20,418,000 barrels of water for 249 wells and 12,222,000 to 47,724,000 barrels of water for 582 wells would be used in the long-term. Usage is comparable to 0.86 to 3.35 days and 2 to 7.82 days of Converse County combined water uses.

Resource	Cumulative Increment	NO ACTION ALTERNATIVE Combined total = 383	PROPOSED ACTION Combined total = 111 well pads/ locations with 140 wells	AGENCY ALTERNATIVE Combined total = 111 well pads/locations with a range of 111 to 444 wells
Wildlife, Special Status Species (SSS), and Threatened and Endangered Species (T&E)	*Past and Present (+)*	Based on the assumptions analyzed within the EAs, the 26 existing wells could account for approximately 91 acres of the existing surface disturbance (long-term) and subsequent removal of wildlife habitat within the three project areas.		
	(RFFA) (+)	The 112 future wells would increase the long-term surface disturbance by approximately 392 acres.		
	Incremental Effect of Alternatives (+)	Under this alternative, there would be 7,815 acres (1.04%) of wildlife habitat removed prior to reclamation and 4,475 acres (0.60%) of wildlife habitat removed throughout the life of the project. The no action alternative yields the highest amount of acres disturbed. Consequently, the potential and extent of impacts from the removal of wildlife habitat would be the highest of the three alternatives, creating the most habitat fragmentation and a moderate amount of disruptive activity.	Under this alternative, there would be 2,116 acres (0.28%) of wildlife habitat removed prior to reclamation and 1,211 acres (0.16%) of wildlife habitat removed throughout the life of the project. The combination of lower number of well pads/locations and the co-location (on the same well pad/location) of some of the proposed wells, the proposed action yields less acres of disturbance when compared to the no action alternative. Consequently, the potential and extent of impacts from the removal of wildlife habitat would be approximately 73% less when compared to the no action alternative, creating minimal habitat fragmentation and disruptive activity.	Under this alternative, there would be 2,169 acres (0.29%) of wildlife habitat removed prior to reclamation and 1,243 acres (0.17%) of wildlife habitat removed throughout the life of the project. The agency alternative yields approximately the same amount of acres disturbed as the proposed action. Due to the co-location (on the same well pad/location) of up to 4 wells per well pad/location this alternative yields the most consolidated footprint and the most shared acres of disturbance. Consequently, the potential and extent of impacts from the removal of wildlife habitat would be the same as the proposed action at the smallest development ratio (1 well per well pad/location) and the lowest of the three alternatives at the largest development ratio (4 wells per well pad/location) when compared to the no action alternative. The agency alternative would cause the greatest extent of disruptive activity at the largest development ratio (4 wells per well pad/ location). However, the disruptive activity and habitat fragmentation would be consolidated across the landscape.

Resource	Cumulative Increment	NO ACTION ALTERNATIVE Combined total = 383	PROPOSED ACTION Combined total = 111 well pads/ locations with 140 wells	AGENCY ALTERNATIVE Combined total = 111 well pads/locations with a range of 111 to 444 wells
	Total by Alternative (=)	Of the 751,688 combined acres within the three project areas, there would be an estimated 4,961 acres (0.66%) of wildlife habitat removed in the long-term.	Of the 751,688 combined acres within the three project areas, there would be an estimated 1,696 acres (0.23%) of wildlife habitat be removed the long-term.	Of the 751,688 combined acres within the three project areas, there would be an estimated 1,728 acres (0.23%) of wildlife habitat removed in the long term.

New Wells Predicted and Associated Surface Disturbance

According to the RFD, the number of new federal oil and gas wells across the CFO planning area, was projected as 1,813 and 815 for non-federal (state and fee) oil and gas wells.

The cumulative number of productive federal wells, with consideration for reclamation and abandonment, was projected as 4,649 and 1,961 for non-federal wells, totaling 6,610 across the CFO planning area.

The associated acres of short-term disturbance for oil and gas exploration and development were projected as 16,285 for BLM actions and 7,344 acres from non-BLM actions. The acres of long-term disturbance were projected as 4,996 for BLM actions and 2,260 for non-BLM actions.

Air Resources

The Casper RMP FEIS projected increases in all pollutants, but qualified that it was unlikely those increases would contribute to exceedance of national or state ambient air quality standards. Oil and gas wells emissions estimation are discussed in Appendix J of the Proposed Resource Management Plan and Final Environmental Impact Statement (FEIS) for the Casper Field Office Planning Area (BLM 2007). In addition, Tables J-24, and J-25 are Summary of Output – Alternative E (Proposed RMP) Total Annual Emissions from Oil Wells – Year 2011 and 2020, respectively. The development contained in the combined cumulative impacts table is consistent with the ROD/RMP and is not anticipated to exceed air quality impacts analyzed in the Casper RMP FEIS.

Water Resources

The SEO water permits define the types of beneficial use, the area of water use, and the quantity of water allowed for use. Water supply needs for oil and gas development, including fracturing, are considered short-term or temporary in nature (Hydraulic Fracturing: A Wyoming Energy Forum) (2012). In the RFD, hydraulic fracturing was discussed as a typical completion technique.

“Wyoming has regulated well stimulation since the 1950s and was the first state to implement rules for hydraulic fracturing in 2010. Wyoming’s rules cover four key areas: 1) the protection of groundwater and the identification of permitted water supply wells within a quarter-mile of the drilling and spacing unit or WOGGC-approved drilling units; 2) clarification of requirements for well integrity, casing setting depths, casing design and cementing properties; 3) requirements for disclosure of well stimulation fluid (frac fluid) chemicals additives, compounds and concentrations or rates; and 4) requirements for the handling of flowback water” (Hydraulic Fracturing: A Wyoming Energy Forum) (2012).

In addition to Wyoming's rules for hydraulic fracturing the BMPs and resource specific mitigation measures for surface disturbing activities, highly erosive soils, water wells, springs, or artesian and flowing wells, and Class I and II Waters are consistent with the ROD/RMP and is not anticipated to exceed the surface and groundwater impacts analyzed in the Casper RMP FEIS.

TRIBES, INDIVIDUALS, ORGANIZATIONS, or AGENCIES CONSULTED

On August 26, 2011, a press release was published soliciting comments for the Hornbuckle Oil and Gas EA, which analyzed 96 wells on 48 well pads in the Hornbuckle oil field, located in northern Converse County. After the 30-day comment period, only two comments were received, of which neither objected to the project.

Due to the nature, scope, scale, and location of the Hornbuckle EA, it is expected that this action would render similar comments, so external public scoping was not conducted.

Internal scoping was performed with an interdisciplinary team of BLM specialists. In addition, multiple operator meetings were held jointly and separately to assist with projections of development, multiple well pad configurations and hydraulic fracturing related technology.

This EA and the two others included in the combined cumulative impacts, as shown on map 2 and discussed in chapter 4 and table 4.4 will all be available for a 30-day comment period before a final decision is made by the authorized officer. Any comments and issues raised that are not already addressed in the documents will be addressed in the EAs at the time a final decision is made.

LIST OF PREPARERS

Name	Agency	Title
Kathleen Lacko	BLM	Project Lead/Planning & Environmental Coordinator
Jude Carino	BLM	Archeologist
Ben Carlisle	BLM	Petroleum Engineer Technician
Shane Evans	BLM	Hydrologist
Tom Foertsch	BLM	Geologist
Shane Gray	BLM	Wildlife Biologist/Natural Resource Specialist
Patrick Juancorena	BLM	Rangeland Management Specialist
Patricia Karbs	BLM	Writer-Editor
Dusty Kavitz	BLM	Rangeland Management Specialist
Matthew Roberts	BLM	Rangeland Management Specialist
Randy Sorenson	BLM	Realty Specialist
Art Terry	BLM	Environmental Protection Specialist
Eric Treloar	BLM	Petroleum Accounting Technician
Jennifer Weber	BLM	Realty Specialist
Wyatt Wittkop	BLM	Wildlife Biologist

REFERENCES

Avian Power Line Interaction Committee (APLIC)..

2006 *Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 2006.* Edison Electric Institute, APLIC, and the California Energy Commission. Washington, D.C. and Sacramento, CA.

BLR® - Business and Legal Resources.

2012 Wyoming Spill Prevention (SPCC Plan): What you need to know. Online version available at http://www.blr.com/Environmental/Emergency-Planning-Response/Spill-Prevention-SPCC-Plan-in-Wyoming.

Brekke, E. B.

1985 "Effects of CO_2 Development on Elk Calving in South-Central Colorado." Unpublished report. Bureau of Land Management. Canon City, CO.

Irwin, L.L. and J. M. Peek.

1979 "Relationship Between Road Closures and Elk Behavior in Northern Idaho." In *North American Elk: Ecology, Behavior and Management.* University of Wyoming. Laramie, WY.

Klein, D. R.

1974 "The Reaction of Some Northern Mammals to Aircraft Disturbance." In *Eleventh International Congress of Game Biologists.* Swedish Environmental Protection Board. Stockholm, Sweden.

Lantz, S. J., H. Smith, and D. A. Keinath.

2004 Species Assessment for Western Burrowing Owl *(Athene cunicularia hypugaea)* in Wyoming. Wyoming Natural Diversity Database. University of Wyoming, Laramie, WY.

Luce, R. and D. Keinath.

2003 Species Assessment for Baird's Sparrow (*Ammodramus bairdii)* in Wyoming. Wyoming Natural Diversity Database. University of Wyoming, Laramie, WY.

McDonald, D., N. M. Korfanta, and S. J. Lantz.

2004 The Burrowing Owl *(Athene cunicularia):* A Technical Conservation Assessment. USDA. Forest Service. Rocky Mountain Region. Online version available at http://www.fs.fed.us/r2/projects/scp/assessments/burrowingowl.pdf

MacArthur, R. A., V. Geist, and R. H. Johnson.

1982 "Cardiac and Behavioral Responses of Mountain Sheep to Human Disturbance." *Journal of Wildlife Management* 46:351-358.

The Center for Climate Strategies.

2010 Wyoming Greenhouse Gas Inventory and Reference Case Projection 1990-2020 (Inventory) for the WDEQ through an effort of the Western Regional Air Partnership (WRAP). Online version available at http://www.climatestrategies.us/library/library/view/411.

Travsky, A. and Dr. Gary P. Beauvais.

2005 Species Assessment for the Ferruginous Hawk (*Buteo regalis)* in Wyoming. Prepared for the United States Department of the Interior, Bureau of Land Management, Wyoming State Office. Cheyenne, WY.

United States. Department of Agriculture, Natural Resources Conservation Service.

1988 Soil Survey of Converse County Northern Part, Wyoming. Online version available at http://soils.usda.gov/survey/printed_surveys/state.asp?state=Wyoming&abbr=WY

2006 Soil Survey of Converse County Southern Part, Wyoming. Online version available at http://soils.usda.gov/survey/printed_surveys/state.asp?state=Wyoming&abbr=WY

2010 Soil Survey of Converse County Southern Part, Wyoming. Online version available at http://soils.usda.gov/survey/printed_surveys/state.asp?state=Wyoming&abbr=WY

2012 National Soil Survey Handbook, title 430-VI. Online version available at http://soils.usda.gov/technical/handbook/.

United States. Department of the Interior. Bureau of Land Management.

2001 *Record of Decision and Approved Newcastle Resource Management Plan.* On file at the Casper Feld Office. Casper, WY.

2007 *Record of Decision and Approved Casper Resource Management Plan*. On file at the Casper Feld Office. Casper, WY.

2012 Wyoming Bureau of Land Management Reclamation Policy. Instruction Memorandum WY-2012-32. Online version available at http://www.blm.gov/wy/st/en/programs/reclamation.html

United States. Department of the Interior. Bureau of Land Management (cont.).

2012 Management of Oil and Gas Exploration and Production Pits. Instruction Memorandum WY-2012-007. Online version available at http://web.wy.blm.gov/Wy.im/12/wy2012-007.pdf

United States. Department of Interior, Fish and Wildlife Service.

2008 Birds of Conservation Concern 2008. Division of Migratory Bird Management, Arlington, Virginia. Online version available at: http://www.fws.gov/migratorybirds/

2009 Classification of Wetlands and Deepwater Habitats of the United States. . Washington, DC. FWS/OBS-79/31. Sept. 25, 2009.

United States. Environmental Protection Agency.

2002 Exemption of Oil and Gas Exploration and Production Wastes from Federal Hazardous Waste Regulations. October 2002. Online version available at: http://www.epa.gov/osw/nonhaz/industrial/special/oil/oil-gas.pdf

United States. Fish and Wildlife Service.

2004 Programmatic Biological Opinion for the Wyoming Bureau of Land Management Resource Management Plan and their effects to the Bald Eagle *(Haliateetus leucocehalus)*. Wyoming Ecological Services Office, Cheyenne, WY.

2010 Memorandum of Understanding between the U.S. Department of the Interior, Bureau of Land Management, and the U.S. Fish and Wildlife Service to Promote the Conservation of Migratory Birds. On file at the BLM, Casper Field Office. Casper. WY.

United States. Geological Services.

2005 Estimated Water Use for Converse County. Online version available at: http://wy.water.usgs.gov/projects/water_use/data2005/counties/converse.htm.

University of Wyoming. School of Energy Resources and Haub School & Ruckelshaus Institute

2012 Hydraulic Fracturing: A Wyoming Energy Forum Summary Report. Online version available at http://www.uwyo.edu/ser/_files/docs/conferences/hydraulic-fracturing/hydraulic-fracturing-summary-report.pdf

Ward, A. L. and J. J. Cupal.

1979 "Telemetered Heart Rate of Three Elk as Affected by Activity and Human Disturbance." In *Proceedings of the ispersed Recreation and Natural Resource Mnagement Symposium.* Utah State University. Logan, UT.

Wyoming Department of Environmental Quality. Water Quality Division.

2012 Wyoming Water Quality Assessment and Impaired Waters List (2012 Integrated 305(b) and 303(d) Report). Cheyenne, WY. Document #12-0203. Online version available at: http://deq.state.wy.us/wqd/watershed/Downloads/305b/2012/WY2012IR.pdf

Wyoming Game and Fish Department.

2005 A Comprehensive Wildlife Conservation Strategy for Wyoming. Cheyenne, WY. Online version available at http://www.wildlifeactionplan.org/pdfs/action_plans/wy_action_plan.pdf

2006 A Plan for Bird and Mammal Species of Greatest Conservation Need in Eastern Wyoming Grasslands. Cheyenne, WY.

Wyoming Partners in Flight.

2003 Wyoming Bird Conservation Plan, Version 2.0. Nicholoff, S. H., compiler. Wyoming Game and Fish Department, Lander, WY.

Wyoming Water Development Office. Basin Planning Program.

2002 Northeast Wyoming River Basins Water Plan and Technical Memoranda. Online version available at http://waterplan.state.wy.us/plan/newy/newy-plan.html.

APPENDIX A

Technical Support Document

The purpose of this technical support document is to discuss the methods and procedures for drilling, completing, and producing oil and natural gas reserves from unconventional reservoirs in the Powder River Basin. Unconventional reservoirs are geologic formations with very low porosity and permeability and are often referred to as "tight". These types of formations have often been considered the source of oil and gas which migrated to conventional reservoirs of higher permeability and porosity. Conventional methods such as drilling vertical wells, sometimes with hydraulic fracture stimulation, may be used with conventional reservoirs with economic success.

For the exploitation of tight or unconventional reservoirs, additional practices and techniques must be used to yield an economic project. This document provides an overview of currently available technology, methodology, and best practices used in the industry today to develop unconventional or tight oil and gas reserves.

The formations currently targeted in the Powder River Basin are frequently tight geologic formations with very low porosity and permeability. Horizontal drilling, combined with hydraulic fracturing, allow these tight formations to be produced economically. By drilling horizontally in a formation, more rock surface area is exposed, allowing greater seepage of oil and gas into the wellbore. The horizontal portion of the well is typically 4,000 – 7,000 feet in length. Shorter or longer laterals may be drilled depending on the circumstances.

Hydraulic fracturing of horizontal wells is also used to further increase the drainage surface area and improve fluid movement from the rock into the well bore. Without the techniques of hydraulic fracturing and horizontal drilling, many more wells would have to be drilled to access the same amount of reserves in a leased area.

Drilling Operations

As a horizontal well, wells are drilled from the well pad, or location, vertically to a predetermined point above the target formation, referred to as the kick off point. Appropriately sized pressure and well control equipment is in place for all drilling activities. Drilling mud is specifically engineered and managed throughout the drilling operation to control the flow of fluids (water, oil and gas) from the well bore. To make up the drilling mud, water is hauled by truck to each location from a commercial source. Approximately 1,000 – 2,000 barrels of fresh water is used to make up the drilling mud used for each well. Drilling operations use both freshwater-based mud and oil-based drilling mud. Drilling mud may be reconditioned and reused for subsequent nearby wells on a case-by-case basis.

Technology commonly used in offshore and difficult drilling conditions, have become valuable tools in horizontal drilling on land. Measurement-while-drilling technology (or

'borehole telemetry') allows engineers and geologists to gain up-to-the-minute subsurface information, even while the well is being drilled. Steerable downhole motor assemblies are also widely used. While conventional drilling occasionally employs the use of downhole motors just above the drill bit to penetrate hard formations, steerable drilling motors allow the actual path of the well to be controlled while drilling.

Surface Casing

All wells have surface casing set to protect the base of fresh water as determined by the state and local agencies. This is accomplished with either a pre-set rig before the bigger drilling rig moves in, or with the drilling rig.

Well casing is steel pipe that is used to line the drilled hole. The casing supports the wall of the well. When it is cemented in place, casing also prevents fluids from migrating between the different penetrated formations. The surface casing provides the mounting base for surface well control equipment.

Cementing is an operation that pumps cement down the casing and into the annulus, or space between the outside of the casing and the drilled hole wall. The surface and intermediate casing are always cemented in place. This mechanically stabilizes the casing string within the hole and seals off fluid flow from the adjacent formations.

Intermediate Casing

Once the base of fresh water is protected, drilling resumes into the target interval. At the kick off point, the well is directionally drilled with specialized tools to steer the well in a curve to the target formation. Frequently, once the wellbore is drilled into the target formation, the intermediate casing is run and cemented. Occasionally, the well is drilled through the formation to its total planned depth before casing is run and cemented. In this case, the casing string run would also be the production casing.

Production Casing

After the intermediate casing is run and cemented, the lateral, or horizontal leg, of the wellbore is drilled in the formation until the total measured depth is reached. The production casing is run to the total measured depth and may or may not be cemented in the formation. The production casing may also have annular packers on it to compartmentalize the lateral section for completion. Another tool commonly used in conjunction with the production casing is frac sleeves in combination with the annular packers or cement.

Open Hole and Cased Hole Well Logs

Various instruments or tools are run in wells and are called logs. Open hole logs are run before the hole is cased and continuously record various measurements along the length of the hole. These measurements are interpreted to provide a record of the

lithologies penetrated and their fluid content. They help determine whether a well will be completed at all and how it will be completed.

Cased hole logs such as the Cement Bond Log are run throughout the vertical portion of the well to evaluate the cementing placed to isolate formations and to protect freshwater sources.

Completion Operations

After the well is drilled, cased, and cemented, the drilling rig is moved off location. The location is redressed to accommodate the completion activities and facilities may be constructed at this time. A completion rig is generally moved onto the well and equipment is moved onto location.

Completion operations may consist of running a frac string or tie back string of casing. This is a temporary casing string run in the vertical section of the well that ties into the production casing. The completion rig is then released so that room is available on location for the frac equipment.

If frac sleeves have been run, then generally the well will not be perforated. If no frac sleeves were run, then perforations will be made in the production casing. The frac sleeves and perforations allow for the stimulation or hydraulic fracturing, the frac, to take place.

Actuating the frac sleeves and perforating generally happen with the frac fleet on location. With the first set of perforations or frac sleeve open, the well bore is now in communication with the target formation and hydraulic fracturing may begin. Water, proppant or sand, and a small amount of chemical additives, all referred to as a slurry, are pumped down the wellbore, through perforations or sleeves in the casing, and into the target formation. The chemical additives are used to ensure the quality of the fracture fluid is adequate to carry the sand or proppant into formation at pressure and temperature very different from surface conditions. Pumping pressures are monitored through the entire program and increased to the point at which fractures initiate in the target formation at the perforations into the formation. The slurry flows into the initiated fractures and helps to extend the fractures away from the well bore in the target formation. The proppant, or sand, props the created fractures open after the pressure drops, leaving easier pathways for reservoir fluids to flow back to the well, when the well is placed on production.

Hydraulic fracturing is a technique developed in the 1940's and was used initially in vertical wells. The technique was implemented in horizontal wells in the 1990's. The physics and geomechanics involved are well understood. The technique of hydraulic fracturing is commonly used on productive reservoirs at depths well below usable aquifers. These depths are frequently in excess of 5,000 feet below potable (drinkable) water. Approximately 20,000 to 80,000 barrels of fresh water may be used for hydraulic

fracturing operations for each well, depending on the lateral length and completion design.

Several diagnostic techniques may be used to monitor hydraulic fracture generation. Among them, down hole microseismic monitoring has been used in the Powder River Basin, and elsewhere, to monitor hydraulic fracture generation and growth. Conventional temperature and chemical tracer surveys and production logging have also been used to monitor the fracturing treatment. These diagnostic techniques have time and again confirmed that hydraulic fracturing is not posing a risk to usable, potable water thousands of feet above the target formation.

Example of Typical Powder River Basin Deep Fracturing Fluid Composition

Below is a representative sample showing the composition, in percent by volume, of a typical frac fluid. Approximately 98% of the fracturing fluid is comprised of water and sand. The sample is from a well posted on the public disclosure website www.fracfocus.org. The fracturing fluid injected into the target formation is confined by thousands of feet of rock layers from shallower potable water aquifers. The function of the fracturing fluid is to transmit energy to the formation to split the rock, and to transport the proppant, or sand. The fracturing fluid is determined based on compatibility with the formation minerals and fluid composition, and recoverability.

Fracturing Fluid = Base Fluid + Additives + Proppant

Table 1. Function of Additives Typically Present in Fracturing Fluid[3]

Materials Used	Use in Hydraulic Fracturing	Other Uses of Material
Guar Gum	Gelling Agent to thicken fluid	Toothpaste, conditioner, shampoo, baked goods, yogurt thickener, ice cream, sherbet, binder in meat products, salad dressing, barbecue sauce, ketchup, instant oatmeal, dry soups, canned fish in sauce
Potassium hydroxide Potassium formate Potassium metaborate	Crosslinkers to superthicken fluid	Soft soap, liquid soap, shaving cream, cuticle oil, electrolyte in alkaline batteries
Ammonium Persulfate Diammonium peroxidisulphate Sodium Persulfate Chlorous Acid or Sodium Chloride	Breakers used to reduce viscocity of the fluid after treatment to allow fluid to flow more easily out of the formation for recovery	Bleach, hair bleach, detergent, fiber and textile dye Table Salt

3 For a more complete list of possible materials and their function, refer to http://fracfocus.org/chemical-use/what-chemicals-are-used

Materials Used	Use in Hydraulic Fracturing	Other Uses of Material
(Salt)		
Isopropanol	Surfactants reduce surface tension to aid in fluid recovery	Antiperspirant, Glass Cleaner, Hair Color
Ethylene glycol Isopropanol Lauryl sulfate	Non-emulsifiers prevent treatment fluid and reservoir liquids from emulsifying	Household cleansers, antifreeze, deicing agent
Sodium Hydroxide, otherwise known as Lye	Biocides kill bacteria to prevent it from destroying gelling agents before the treatment can be pumped	Thicken ice cream, soft drinks, pretzels, soap, detergent, drain cleaner, oven cleaner

Production Operations

Facilities

Production facilities at each location typically include a well head and rod pump jack, heater-treater, recirculating pump, and a tank battery typically comprised of 4 to 8 storage tanks. Flare pits are sometimes used to flare gas when gas pipelines are not present. Sometimes, a gas lift system or electric submersible pump may be used instead of a rod pump jack. Any of these artificial lift methods used on non-flowing wells require power, which may come from a generator, or electric power service, if available. Production facilities are installed on the disturbed portion of each well pad, a minimum of 25 feet from the toe of the back slope, wherever practical.

Produced fluids are stored on each well pad in tanks. Oil tanks and water tanks are typically 400 or 500-barrels in size and are placed inside of a containment device constructed completely around production facilities. The containment devices consist of impervious compacted subsoil or lined structures and hold a minimum of 110% of the capacity of the largest tank. Each Operator develops and maintains site-specific Spill Prevention, Control, and Countermeasure Plans (SPCCPs) for each production facility.

Produced Water

Produced water and completion flowback water is separated from the oil and gas and stored in tanks. The water is then either trucked (if no pipeline is present) or piped to private underground injection wells, commercial underground injection wells, or commercial evaporation pond facilities. All underground injection wells and water disposal facilities are permitted by the state of Wyoming.

Oil and Natural Gas Transportation

Oil separated from the water and gas from each well is held in a tank and either trucked to a pipeline gathering point, or transported via gathering pipeline directly from the well into a main oil pipeline.

Gas separated from the oil and water is generally transported via gathering pipeline directly to a gas gathering point. The pit flare may be used to burn gas in the event some activity resulted in the gas quality not meeting gas line specifications. Once the gas quality meets specifications, the gas would again go directly to sales.

Measurement of all produced fluids is made per Onshore Order specifications and state of Wyoming rules, and reported to the state of Wyoming and the federal government per regulatory reporting requirements.

APPENDIX B

APD/NOS Statistics

East Converse EA APD/NOS Statistics Table

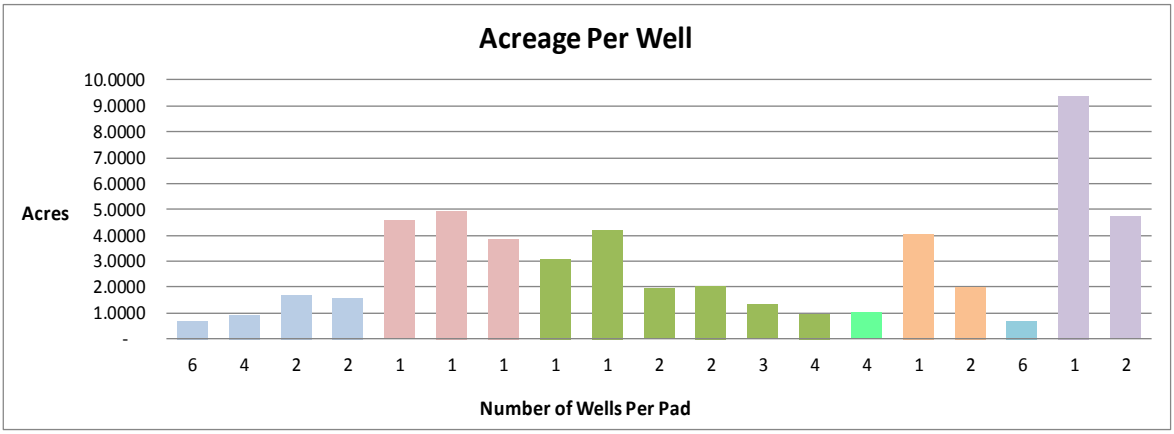
Well Ratio to Well Pad/Location	Pad Disturbance (acres)	Road Disturbance (acres)	Pipeline Disturbance (acres)	Powerline Disturbance (acres)
1 of 1	4.0404	0.5969	0.2388	0.2388
1 of 1	3.2283	22.4242	8.9697	8.9697
1 of 1	4.0404	5.4545	2.1818	2.1818
1 of 1	5.3429	3.8468		
1 of 1	3.2283	12.2452	4.8981	4.8981
1 of 1	3.2283	12.3967	4.9587	4.9587
1 of 1	3.2283	2.6492	1.0597	1.0597
1 of 1	4.9357	8.2587	3.3049	3.3049
1 of 1	4.9929	7.7516		
1 of 2	2.4793	0.5091	0.7273	0.7273
2 of 2				
1 of 1	2.2096	0.4017	0.1607	0.1607
1 of 2	2.4793	0.2296	0.0918	0.0918
2 of 2				
1 of 1	5.6929	2.2484		
1 of 2	2.3140	0.1722	0.0689	0.0689
2 of 2				
1 of 1	3.0854	1.7218	0.6887	0.6887
1 of 1	1.8652	4.1322	1.6529	1.6529
1 of 1	3.0854	11.0193	4.4077	4.4077
1 of 1	1.8222	0.8609	0.3444	0.3444

Pad Disturbance Total (acres)	61.2990 *
Pad Disturbance Per Well Average(acres)	2.9190
Road Disturbance Total (acres)	96.9190 *
Road Disturbance Per Well Average (acres)	4.6152

* Total calculations are based on actual numbers and information submitted from NOS and APD.

Average Acreage Statistics for One-Well & Four-Well Pads for Alternative Table

No. of Pads[1]	No. of Wells per Pad[2]	Operator Well Projection as Drawn[2]	Acres per Pad	Well Pad Total Acreage[3]	Acreage per Well	ADP's & NOS's (Proposed Action)[1]	APD's & NOS's Total Wells	Pad Disturbance Total (acres)	Average Acreage per Well (Proposed Action)	Total No. of Pads
4	6	24	4.1144	16.4578	0.6857					
3	4	12	3.7453	11.2359	0.9363					
6	2	12	3.3761	20.2569	1.6881					
2	2	4	3.1916	6.3831	1.5958	32				
7	1	7	4.5914	32.1396	4.5914					
1	1	1	4.9357	4.9357	4.9357					
2	1	2	3.8740	7.7479	3.8740	10				
1	1	1	3.0854	3.0854	3.0854					
1	1	1	4.2039	4.2039	4.2039					
1	2	2	3.9463	3.9463	1.9731		79	234.8543	2.9728	56
1	2	2	4.1139	4.1139	2.0569					
1	3	3	3.9463	3.9463	1.3154					
2	4	8	3.9463	7.8926	0.9866	9				
5	4	20	4.0404	20.2020	1.0101	5				
12	1	12	4.0393	48.4711	4.0393					
2	2	4	4.0393	8.0785	2.0196	16				
3	6	18	4.3072	12.9215	0.7179	4				
1[4]	1	1	9.3664	9.3664	9.3664					
1	2	2	9.4697	9.4697	4.7348	3				
Average Acreage of One-Well Pads[5]				4.1910		Average Acreage of Four-Well Pads[6]			3.9330	



[1]The No. of Pads and the APD's & NOS's (Proposed Action) columns reflect the number of well pads and wells per well pad/location, based on APDs & NOSs submitted by the operators.

[2]The No. of Wells per Pad and Operator Well Projection as Drawn calculations are based on the diagrams submitted by the operators. The diagrams project their future plans of development related to the number of wells per well pad/locations. Not every well drawn has been formally submitted by

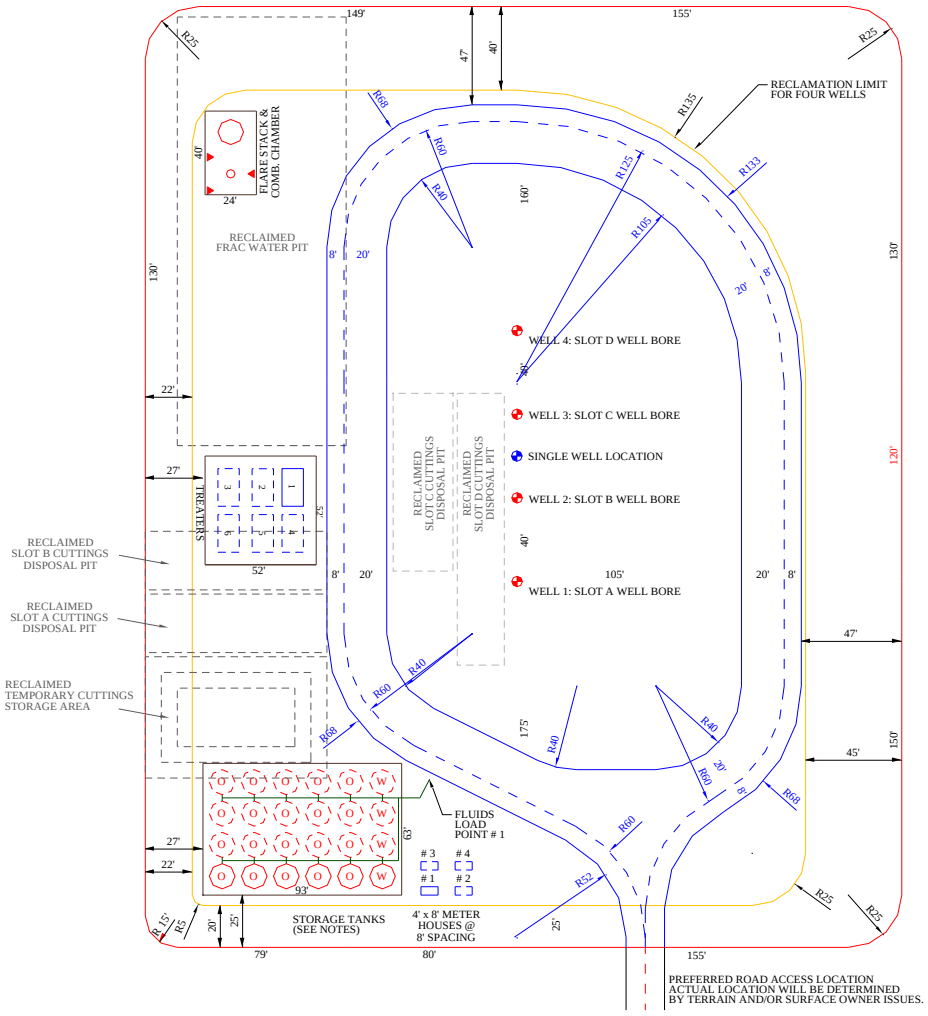
[3]The data utilized in the Well Pad Total Acreage is from submitted APD's & NOS's from Spearhead Ranch EA. These calculations are being utilized for Highland Loop and East Converse EAs because it contained the largest sample size of the three EA's.

[4]Not included in Average Acreage of One-Well Pads.

[5]Value rounded to 4.2.

[6]Actual average from Spearhead Ranch EA submissions, but slightly lower than the average used in the Chapter 2 assumptions and the subsequent analysis for all three EAs. The one-well pad average was used in all three EAs for the four-well pad average as well as the one-well average because it was slightly larger. This was based on slightly larger four-well pads for the other two project areas and the probability that initial construction may be for only one well until production can be verified.

Typical Production Facility Layout



NOTES:
1. The drawing shows the proposed location of production equipment and the proposed fluids haul loop route.
2. The storage tanks are 12' diameter by 20' height with a capacity of 400 bbls. The estimated storage volume required per well is 2000 bbl of oil and 400 bbl of water. The spacing between tanks is 3 feet.
3. The storage tanks and treaters will usually be placed near the positions shown. An earthen berm or steel spill barrier will be erected on the perimeter of the tanks, flare stack and treaters. Dependent upon the access road location, it may be necessary to locate the flare stack and meter house in different positions. In any case, the minimum safety spacing will be observed. The minimum spacing utilized is 100 feet between wells and tanks and treaters. The minimum spacing of 125 feet between a flare and wells and tanks and treaters.
4. The position of the well service anchors is the four points at 100 feet forward and 100 feet back of the well bore and 50 feet left and 50 feet right of the well bore.
5. The interim reclamation limit is estimated to lie outside the anchors and production equipment as shown.
6. The area of the pad within the pad perimeter is 3.6 acres prior to interim reclamation. The area of the pad within the proposed interim reclamation boundary for the four wells 2.5 acres. Thus approximately 68 % of the area of original pad will be used for production operations.

PRODUCED FLUIDS HAUL LOOP ROUTE NOTE:
1. The haul route center line is proposed as shown. The shoulders of the route are shown to illustrate the validity of this route. The nominal width is 16', with 8' on each side of center line. Curve widening on the inside of curves is shown where the widening is 12' for a radius of 60'. Although a curve widening of 4' for a radius of 125' is sufficient, a value of 12' is used to simplify construction. This configuration will support a tractor-trailer-pup combination hauling unit. The entry point to the haul loop would be determined by the actual entry point of the road. The radius of the approach to the haul loop should be a minimum of 50 feet as shown in this example.

PRJ. #:	SUR:	SCALE: 1" = 50'	OWNER	PROJECT	DRAWING TITLE
REC:	DES:	0 50 100	COMPANY NAME AND ADDRESS	TYPICAL WELL SITE FOR PRODUCTION ACTIVITIES 4 WELLS - 40' SPACING - 400 BBL TANKS	DRAWING DESCRIPTION TYPICAL PRODUCTION FACILITY LAYOUT
DWG:	DWN:				
PREPARED BY: CONSULTING ENGINEER SURVEYORS - ENGINEERS - CONSTRUCTORS					

APPENDIX C

Geologic Formations

The Powder River Basin is one of the richest petroleum provinces in the Rocky Mountains. The basin is a deep, northerly trending, asymmetric, mildly deformed trough, approximately 250 mi long and 100 mi wide. More than 2.7 billion barrels of recoverable oil and over 2.3 trillion cubic feet gas have been discovered in about 700 fields, of which about 225 fields are greater than 1 million barrels oil equivalent in size.

Hydrocarbons occur in reservoirs ranging in age from Mississippian to Late Cretaceous in both structural and stratigraphic traps. Plays in this basin are of both structural and stratigraphic types and occur in three major petroleum source rock and reservoir systems-Pennsylvanian-Permian, Lower Cretaceous, and Upper Cretaceous. Oil and gas plays in the southern Powder River Basin within the BLM Casper Field Office that are part of the proposed action for this Environmental Assessment are listed below.

Lakota Sandstone Play

This play is characterized by the occurrence of oil in stratigraphic traps of the basal Inyan Kara Group in the structurally uncomplicated portions of the basin. The traps are within channel sandstones of alluvial or deltaic origin. These traps also occur in combination with structural noses or anticlinal closures outside of the play area.

The play is generally lightly explored due to the small size, unpredictability, and difficulty of finding accumulations.

Vertical pilot holes for horizontal wells exploring reservoirs higher in the geologic section sometimes penetrate down to the Morrison Formation to explore and develop this play.

Fall River Sandstone Play

This play is characterized by oil and gas occurrence in stratigraphic traps within the coarse grained sediments of the Fall River Formation (Dakota Sandstone) of the Lower Cretaceous Inyan Kara Group. It is composed of a marine, deltaic, and alluvial complex.

Exploration in the play has continued for approximately 30 years and has resulted in the discovery of more than 30 individual pools or fields, aggregating about 170 MMBO (known recoverable oil) and 110 BCFG. The largest accumulation, South Glenrock Creek field, contains approximately 38 MMBO (known recoverable oil). Exploration is currently expanding into deeper parts of the basin. Vertical pilot holes for horizontal wells exploring reservoirs higher in the geologic section sometimes penetrate down to the Morrison Formation to explore and develop this play.

Muddy Sandstone Play

This play describes the occurrence of oil and gas in stratigraphic traps of the Lower Cretaceous Muddy-Newcastle Sandstone complex of the Powder River Basin and is characterized by a suite of trap types related to a variety of depositional environments. These include marine bar, strandline, distributary channel, estuarine, alluvial and lower delta plain sandstone bodies.

Vertical pilot holes for horizontal wells exploring reservoirs higher in the geologic section sometimes penetrate down to the Morrison Formation to explore and develop this play.

Mowry Fractured Shale Play

Lower Cretaceous Mowry Shale thicknesses range from about 100 ft. to more than 400 ft. and average about 250 ft. The highly fractured shale constitutes the reservoir. Hydrocarbons accumulated contemporaneously with fracture development which is associated with over pressuring and thermal maturation of the organic matter. The trap consists of intensive fracturing in the Mowry Shale contained by overlying ductile Cretaceous shale and laterally un-fractured Mowry Shale.

The Mowry is amenable to horizontal drilling and completion techniques. Exploration is just beginning in this play; however, at least six fields in the deeper parts of the basin have shown production from fractured Mowry Shale, usually in conjunction with productive Muddy Sandstone.

Deep Frontier Sandstone Play

In this play, oil and gas occur in stratigraphic traps in offshore marine shelf sandstones of the Upper Cretaceous Frontier Formation in large, high-energy sand bar complexes, located in the deeper parts of the present basin. The play is in the central and southern parts of the Powder River Basin.

Discrete sandstone reservoirs, known as “First Wall Creek”, “First Frontier”, or Turner Sandstones, are the principal objectives in this play. Similar sandstones lower in the formation are prospective in the western part of the basin and are included within the play. Most of these sandstone bodies trend Northwest-Southeast, although they coalesce locally into less regular configurations. Drilling depths to prospective future traps will range from 8,000 to 13,000 ft.

Turner Sandstone Play

This play is defined by the occurrence of oil and gas in stratigraphic traps in offshore marine shelf sandstones of the Turner Sandstone Member of the Upper Cretaceous Carlile Shale on the shallow east flank of the basin.

Traps occur both as transverse bars and as less well defined, generally thin bar complexes of irregular shape. These sandstones are the general equivalent of the “First Frontier” or “1st Wall Creek” sandstones of the western flank of the basin. Seals are associated fine-grained marine rocks of the Carlile Shale and Frontier Formation. Drilling depths for prospective traps generally range up to 8,000 ft.

Niobrara Fractured Shale Play

This unconventional play is defined by the occurrence of oil and associated gas principally in fractured shale reservoirs of the Niobrara Formation. In some instances, fractures appear localized or enhanced on structural flexures and faults.

The highly organic Niobrara Shale is considered both a reservoir and source. Hydrocarbons released produce high-gravity oil. The Niobrara Shale is also the source of hydrocarbons that migrated into many of the Upper Cretaceous sandstone reservoirs.

The Niobrara is amenable to horizontal drilling and completion techniques. Conventional drilling has produced modest amounts of oil at West Salt Creek and Smokey Gap in the Powder River Basin, and a small amount of production from Niobrara exists in deep parts of the basin; however, the play is in the early stages of exploration and development.

Sussex-Shannon Sandstone Play

This play encompasses hydrocarbon accumulations in stratigraphic traps in the Sussex and Shannon Sandstone Members of the Upper Cretaceous Cody Shale. These two units are interpreted to have been deposited as offshore bar complexes. The play occurs in the deep part of the basin.

Traps are stratigraphic in a series of relatively narrow and sinuous sandstone reservoirs within overall sand bodies which are much broader and have relief on the order of tens of feet over several miles. Traps are classic up dip pinch outs of porous and permeable shelf sandstone bars into shale. Drilling depths range from 7,000 to 11,000 ft.

Mesaverde-Lewis Play

This play involves oil and gas occurrence in stratigraphic traps in marine sandstones of the Upper Cretaceous Mesaverde Formation and Lewis Shale. The play area is an elongate, northwesterly trend in the deep, central part of the basin.

Reservoirs are porous sandstones within the Teapot and Parkman Sandstone Members of the Mesaverde, and the Teckla Sandstone Member of the Lewis Shale. Traps are created by up dip pinch out of shallow marine sandstones into finer grained sediments. The Parkman Sandstone characteristically produces from accumulations trapped within northwest-trending marine bar sandstones. Depth to objective traps ranges from 5,000 ft. to about 9500 ft. in the axial parts of the basin.

References

Anna, L.O., 2010, Geologic Assessment of Undiscovered Oil and Gas in the Powder River Basin Province, Wyoming and Montana: U.S. Geological Survey Digital Data Series DDS–69–U.

Dolton, G.L., and Fox, J.E., 1995, National Oil and Gas Assessment, Powder River Basin Province (033): U.S. Geological Survey Web site http://energy.cr.usgs.gov/oilgas/noga/1995.html, Powder River Basin.

APPENDIX D

Reclamation Guidelines

During the life of the development, all disturbed areas not needed for active support of production operations should undergo “interim” reclamation in order to minimize the environmental impacts of development on other resources and uses. At final abandonment, well locations, production facilities, and access roads must undergo “final” reclamation so that the character and productivity of the land and water are restored.

The objective of interim reclamation is to minimize or eliminate erosion, stabilize the disturbed soils, return the topsoil to productivity and to reduce the amount of final reclamation needed at the end of the project.

The long-term objective of final reclamation is to set the course for eventual ecosystem restoration, including the restoration of the natural vegetation community, hydrology, and wildlife habitats. In most cases, this means returning the land to a condition approximating or equal to that which existed prior to the disturbance. The operator is generally not responsible for achieving full ecological restoration of the site. Instead, the operator must achieve the short-term stability, visual, hydrological, and productivity objectives of the Bureau of Land Management (BLM) *and* take the steps necessary to ensure that long-term objectives will be reached through natural processes.

The reclamation process involves restoring the original landform or creating a landform that approximates and blends in with the surrounding landform. It also involves salvaging and reusing all available topsoil in a timely manner, re-vegetating disturbed areas to native species, controlling erosion, controlling invasive non-native plants and noxious weeds, and monitoring results. Reclamation measures should begin as soon as possible after the initial disturbance and continue until successful reclamation is achieved. With proper reclamation measures, over time, local native species will become re-established on the site and the area will regain its original productive and scenic potential.

Reclamation generally can be judged successful when the site has been stabilized, a self-sustaining, vigorous, diverse, native (or otherwise approved) plant community is established on the site, with a density sufficient to control or eliminate erosion, non-native plant invasion and to re-establish wildlife habitat or forage production. Erosion control is generally sufficient when adequate groundcover is reestablished, water naturally infiltrates into the soil, and gullying, headcutting, slumping, and deep or excessive rilling is not observed. The site must be free of state- or county-listed noxious weeds and undesirable vegetation species, oil field debris, contaminated soil, and equipment. The operator should inform the BLM that reclamation has been completed and that the site is ready for final inspection when these requirements have been met.

Surface Use Plan of Operations

As part of the APD process, the operator shall include a Surface Use plan of Operations. The Surface Use Plan of Operations must:

- Describe the access road(s) and drill pad, the construction methods that the operator plans to use, and the proposed means for containment and disposal of all waste materials;
- Provide for safe operations, adequate protection of surface resources, groundwater, and other environmental components;
- Include adequate measures for stabilization and reclamation of disturbed lands;
- Describe any Best Management Practices the operator plans to use; and
- Where the surface is privately owned, include a certification of Surface Access Agreement or an adequate bond, as described in Section VI of ~~One Shore~~ Onshore Order Number One.

All maps that are included in the Surface Use Plan of Operations must be of a scale no smaller than 1:24,000, unless otherwise stated below.

Geospatial vector and raster data must include appropriate attributes and metadata. Georeferenced raster images must be from the same source as hardcopy plats and maps submitted in the APD package. All proposed on-lease surface disturbance must be surveyed and staked as described below in items A and B, including:

- The well location;
- Two 200-foot (61-meter) directional reference stakes;
- The exterior pad dimensions;
- The reserve pit;
- Cuts and fills;
- Outer limits of the area to be disturbed (catch points); and
- Any off-location facilities.

Proposed new roads require centerline flagging with stakes clearly visible from one to the next. In rugged terrain, cut and fill staking and/or slopestaking of proposed new access roads and locations for ancillary facilities that may be necessary, as determined by the BLM. The onsite inspection will not occur until the required surveying and staking have taken place.

Plans for Surface Reclamation*:* The operator must submit a plan for the surface reclamation and stabilization of all disturbed areas. This plan must address interim (during production) reclamation for the area of the well pad not needed for production, as well as final abandonment of the well location. Such plans must include, as appropriate:

- Configuration of the reshaped topography;
- Drainage systems;

- Segregation of spoil materials (stockpiles);
- Surface disturbances;
- Backfill requirements;
- Proposals for pit/sump closures;
- Redistribution of topsoil;
- Soil treatments;
- Seeding or other steps to reestablish vegetation;
- Weed control; and any
- Practices necessary to reclaim all disturbed areas, including any access roads, pipelines and power lines.

The operator may amend this reclamation plan at the time of abandonment.

A. Surface Disturbing Operations

Lessees and operators must submit to the BLM a request on Form 3160–5 before:

- Undertaking any subsequent new construction outside the approved area of operations; or
- Reconstructing or altering existing facilities including, but not limited to, roads, emergency pits, firewalls, flowlines, or other production facilities on any lease that will result in additional surface disturbance. If, at the time the original APD was filed, the lessee or operator elected to defer submitting information under Section III.E.3.d.(Location of Existing and/or Proposed Facilities) of ~~On Shore~~ Onshore Order Number One, the lessee or operator must supply this information before construction and installation of the facilities. The BLM may require a field inspection before approving the proposal. The lessee or operator may not begin construction until the BLM approves the proposed plan in writing. The operator must certify on Form 3160–5 that they have made a good faith effort to provide a copy of any proposal involving new surface disturbance to the private surface owner in the case of split estate.

B. *Surface Protection.* Except as otherwise provided in an approved Surface Use Plan of Operations, the operator must not conduct operations in areas subject to mass soil movement, riparian areas, floodplains, lakeshores, and/or wetlands. The operator also must take measures to minimize or prevent erosion and sediment production. Such measures may include, but are not limited to:

- Avoiding steep slopes and excessive land clearing when siting structures, facilities, and other improvements; and
- Temporarily suspending operations when frozen ground, thawing, or other weather-related conditions would cause otherwise avoidable or excessive impacts.
- Utilizing erosion control methods such as but not limited to re-vegetating the disturbed areas as soon as possible, erosion control mats, waddles, mulch, hydro-mulch, silt fences, water bars, eyebrow ditches, diversion ditches, wing

ditches, gabion baskets or riprap and any other method approved by the authorized officer.

Reclamation of Highly Erosive Soils, and Slopes Greater Than 25%

Highly Erosive Soils

Casper Resource Management Plan approved December 2007 table 1-1, Goals, Objectives, and Decisions/Management Actions:

Decision # 1017: Goal/Objective: PR: 4.1: On BLM-administered surface, conduct onsite soil investigations on highly controversial projects, or in area of highly erosive soils, to evaluate the impacts of surface-disturbing activities. Onsite soil investigations may include mapping the soils to a series level, evaluating current erosion conditions, and prescribing mitigation and reclamation practices.

Decision # 1020: Goal/Objective: PR: 4.2: Minimize the disturbance to highly erosive soils. Proposed surface-disturbing activities will be modified (located) to avoid areas of highly erosive soils to the greatest extent practicable.

When avoidance of highly erosive soils is not practicable, the operator shall submit an individual site plan to and approved by the authorized officer meeting the following requirements. Engineered drawings for construction, site drainage design, and final rehabilitation contours with a written rational describing how the proposed controls will prevent slope failure and erosion, while maintaining viable topsoil for final reclamation. This plan should also include a timeline identifying the actions that will be applied during the construction, production, and rehabilitation phases of the plan so appropriate monitoring protocols can be developed by the BLM to ensure that the plan is meeting the objective described in its rationale.

Decision # 1021: Goal/Objective: 4.2: The requirement to use temporary protective surface treatment on disturbed areas is applied on a case-by-case basis as project conditions warrant.

Slopes Greater Than 25%

Casper Resource Management Plan approved December 2007 table 1-1, Goals, Objectives, and Decisions/Management Actions:

Decision # 1021: Goal/Objective: 4.2: The requirement to use temporary protective surface treatment on disturbed areas is applied on a case-by-case basis as project conditions warrant.

Decision# 1022: Goal/Objective: 4.2: Surface disturbance or development on slopes greater than 25% is prohibited, unless individual site plans are submitted to and approved by meeting the following requirements. Engineered drawings for construction,

site drainage design, and final rehabilitation contours with a written rational describing how the proposed controls will prevent slope failure and erosion, while maintaining viable topsoil for final reclamation. This plan should also include a timeline identifying the actions that will be applied during the construction, production, and rehabilitation phases of the plan so appropriate monitoring protocols can be developed by the BLM to ensure that the plan is meeting the objective described in its rationale.

Reclamation Plan

A reclamation plan that conforms to Instructional Memorandum WY-2012-032 (Wyoming Bureau of Land Management Reclamation Policy) shall be included with the Surface Use Plan of Operations and shall discuss plans for both interim and final reclamation. Reclamation is required of any disturbed surface that is not necessary for continued production operations. The operator shall submit a new reclamation plan with the Notice of Intent to Abandon (NIA) or Subsequent Report Plug and Abandon (SRA) using the Sundry Notices and Reports on Wells Form 3160-5 when abandoning wells and other facilities that do not have an approved reclamation plan or when the operator would like to update the plan. Additional reclamation measures may be required based on the conditions existing at the time of abandonment and made a part of the conditions of approval of the NIA or SRA. Earthwork for interim and final reclamation generally must be completed within 6 months of well completion or plugging (weather permitting).

Well Site Reclamation

Well site reclamation includes both interim and final reclamation.

Pit Reclamation

All pits closures must conform to Instructional Memorandum WY-2012-007 (Management of Oil and Gas Exploration and Production Pits) and reclaimed to a safe and stable condition and restored to a condition that blends with the rest of the reclaimed pad area. If it was necessary to line the pit with a synthetic liner, the pit must not be breached (cut) or filled (squeezed) while still containing fluids. Pits must be free of oil and other liquid and solid wastes prior to filling. Pits may be allowed to air dry or may be solidified in place with BLM approval. The pit liner must be removed to the solids level or treated to prevent its reemergence to the surface or its interference with long-term successful re-vegetation. If necessary, the pit area should usually be mounded slightly to allow for settling and positive surface drainage.

The concentration of nonexempt hazardous substances in the reserve pit at the time of pit backfilling must not exceed the standards set forth in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 42 USC 9605, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), PL 99-499. All oil and gas drilling-related CERCLA hazardous substances removed from a location and not reused at another drilling location must be disposed of in accordance with applicable federal and state regulations. {(Refer to 42 USC

9601(14)(Definition of “hazardous substances”); 42 USC 6921(2)(A)(exclusion of certain wastes associated with exploration and production); EPA 530-95-003, Crude Oil and Natural Gas Exploration and Production Wastes: Exemption from RCRA Subtitle C Regulation (May 1995)}. Only those hazardous wastes that qualify as **exempt,** under the Resource Conservation and Recovery Act (RCRA), Oil and Gas Exemption, may be disposed of in the reserve pit. *Generally, oil or gas wastes are exempt if they 1) have been sent down hole and then returned to the surface during oil/gas operations involving exploration, development, or production, or 2) have been generated during the removal of produced water or other contaminants from the oil/gas production stream.*

Interim Reclamation

Interim reclamation consists of minimizing the footprint of disturbance by stabilizing and reclaiming all portions of the well site not needed for production operations. The portions of the cleared well site not needed for operational and safety purposes are re-contoured to a final or intermediate contour that blends with the surrounding topography as much as possible. Sufficient level area remains for setup of a workover rig and to park equipment. In some cases, rig anchors may need to be pulled and reset after re-contouring to allow for maximum reclamation. Topsoil shall be respread over areas not needed for all-weather operations. When practical, the operator should respread topsoil over the entire location and re-vegetate to within a few feet of the production facilities, unless an all-weather, surfaced, access route or turnaround is needed. Production facilities should be clustered or may be placed offsite to maximize the opportunity for interim reclamation. In order to inspect and operate the well or complete workover operations, it may be necessary to drive, park, and operate on restored, interim vegetation within the previously disturbed area. This is generally acceptable provided damage is repaired and reclaimed following use. Under some situations, such as the presence of moist, clay soils, the operator or surface management agency may prefer that vegetation and topsoil be removed during workover operations and restored following operations to prevent soil compaction.

To reduce final reclamation costs; maintain healthy, biologically active topsoil; and to minimize habitat, visual, and forage loss during the life of the well, all salvaged topsoil shall be spread over the area of interim reclamation, rather than stockpiled. Where the topography is flat and it is, therefore, unnecessary to re-contour the well location at the time of final reclamation, the operator may set aside sufficient topsoil for final reclamation of the small, unreclaimed area around the wellhead. Topsoil stored for a period greater than 90 days will not exceed piles of 3 feet in depth and will be seeded with a BLM approved seed mix to prevent wind and water erosion and to reduce the loss of microbial activity within the soil.On sloped ground, during final reclamation, the topsoil and interim vegetation must be restripped from portions of the site that are not at the original contour, the well pad re-contoured, and the topsoil respread over the entire disturbed site to ensure successful re-vegetation.

Site Preparation and Re-vegetation

Disturbed areas should be re-vegetated after the site has been satisfactorily prepared. Site preparation will include respreading topsoil to an adequate depth, and may also include ripping, tilling, disking on contour, and dozer track-imprinting. The operator will usually be advised of the re-vegetation methods, objectives, and seasons to plant, unless this information is included in the Application for Permit to Drill (APD) reclamation plan. Native perennial species or other plant materials specified by the BLM or private surface owner will be used. Seeding should be accomplished by drilling on the contour whenever practical or by other approved methods such as dozer track-walking followed by broadcast seeding. Seeding or planting may need to be repeated until re-vegetation is successful, as determined by the surface management agency.

When conditions are not favorable for the establishment of vegetation, such as periods of drought or the lack of sufficient salvaged topsoil, the surface management agency may allow for subsequent reseedings to be delayed until soil moisture conditions become favorable or may require additional cultural techniques such as mulching, fertilizing, irrigating, fencing, or other practices. It is the operator's responsibility to monitor the site, take the necessary steps to ensure reclamation success, and to notify the surface management agency when success is achieved.

Reclamation is most effective when the ecology of the site is considered. The previous plant community or potential plant community native to the site should be identified to help determine the plant communities that can exist on the reclaimed site. Re-vegetation efforts will be hampered and costs increased if the site contains conditions detrimental to re-vegetation, such as heavy grazing pressure, insufficient salvaged topsoil, erosion, and compacted or contaminated soil.

Additional Guidelines

Supplemental guidelines and methods may be available that reflect local site and geographic conditions. These guidelines or methods may be obtained from the BLM. Technical advances in reclamation practices are continually being developed that may be successfully applied to lands affected by oil and gas development.

Pipeline, flowline and buried utility reclamation

Pipeline and buried utility routes and roads shall be co-located as much as possible to reduce reclamation needs and impacts to other resources. Pipeline trenches are to be compacted during backfilling and must be maintained to correct backfill settling and prevent erosion. Reclamation involves placing fill in the trench, compacting the fill, regrading cut-and-fill slopes to restore the original contour, replacing topsoil, installing temporary waterbars only where necessary to control erosion, and re-vegetating in accordance with a reclamation plan. Waterbars and other erosion control devices must be maintained and repaired as necessary.

Following successful re-vegetation, surviving water-bars must be flattened to blend with the slope and then re-vegetated. If berms of topsoil were originally placed over the trench to accommodate settling, the surviving berms should also be flattened to blend with the surrounding landform and re-vegetated.

Final abandonment of pipelines and flowlines will involve flushing and properly disposing of any fluids in the lines. All surface lines and any lines that are buried close to the surface that may become exposed due to water or wind erosion, soil movement, or anticipated subsequent use, must be removed. Deeply buried lines may remain in place unless otherwise directed by the AO.

Road Reclamation

Interim reclamation consists of reclaiming portions of the road not needed for vehicle travel. Wherever possible, cut slopes, fill slopes, and borrow ditches should be covered with topsoil and re-vegetated to restore habitat, forage, scenic resources, and to reduce soil erosion and maintenance costs.

At abandonment, roads must be reclaimed by the operator unless the BLM or surface owner requests that they be left unreclaimed.

Final reclamation includes re-contouring the road back to the original contour, seeding, controlling noxious weeds, and may also include other techniques to improve reclamation success, such as ripping, scarifying, replacing topsoil, constructing waterbars, pitting, mulching, redistributing woody debris, and barricading.

Seeds of native, perennial species or other plant materials specified by the BLM or surface owner must be used. If waterbars were used, they should be removed and seeded following successful re-vegetation.

Plugging the Well

Well abandonment operations may not be started without the prior approval of the Sundry Notices and Reports on Wells, Form 3160-5, by the authorized officer. The Sundry Notice serves as the operator's NIA. In the case of newly drilled dry holes, failures, and emergencies, oral approval may be obtained from the AO subject to written confirmation. The operator must contact the BLM prior to plugging a well to allow for approval and witnessing of the plugging operations.

Final Reclamation

Following well plugging, well sites that do not blend seamlessly with the surrounding landform (contour) should not be left in place, even if there has been successful regrowth of vegetation on the site. Re-vegetation alone does not constitute successful reclamation. Restoration of the original landform is a key element in ensuring that the effects of oil and gas development are not permanent.

To achieve final reclamation of a recently drilled dry hole, the well site must be re-contoured to original contour or a contour that blends with the surrounding landform, any stockpiled topsoil evenly redistributed, and the site re-vegetated. To achieve final reclamation of a formerly producing well, all topsoil and vegetation must be restripped from all portions of the old well site that were not previously reshaped to blend with the surrounding contour. All disturbed areas are then re-contoured back to the original contour or a contour that blends with the surrounding landform, topsoil is redistributed, and the site re-vegetated.

In re-contouring areas that have been surfaced with gravel or similar materials, the material must be removed from the well location or buried deep in the re-contoured cut to prevent possible surface exposure. All excavations and pits must be closed by backfilling when they are dry and free of waste and graded to conform to the surrounding terrain.

Salvaged topsoil must be respread evenly over the surfaces to be re-vegetated. The topsoiled site should be prepared to provide a seedbed for reestablishment of desirable vegetation. Site preparation may include gouging, scarifying, dozer track-walking, mulching, fertilizing, seeding, and planting.

Water breaks and terracing should only be installed when absolutely necessary to prevent erosion of fill material and should be removed when the site is successfully re-vegetated and stabilized.

Reclamation of Other Associated Facilities

Other facilities and areas of surface disturbance associated with federal oil and gas lease development, including water impoundments, power lines, metering buildings, compression facilities, and tank batteries must be removed and reclaimed in accordance with the standards identified previously and with the requirements of the surface management agency or surface owner.

Inspection and Final Abandonment Approval

The operator must file a Subsequent Report Plug and Abandon (SRA) following the plugging of a well. A Final Abandonment Notice (FAN) must be filed by the operator upon completion of reclamation operations, which indicates that the site meets reclamation objectives and is ready for inspection. Upon receipt of the Final Abandonment Notice, the BLM will inspect the site to ensure reclamation is fully successful.

The BLM must approve the Final Abandonment Notice. Final abandonment will not be approved by the BLM until the surface reclamation work required by the APD, Notice of Intent to Abandon, or Subsequent Report Plug and Abandon has been completed and the required reclamation is acceptable to the BLM. The operator is responsible for monitoring reclamation progress and taking the necessary actions to ensure success.

Control of Noxious and Invasive Weed Species

Noxious and invasive weed species shall be controlled on all surface disturbance areas in the project area by the use of mechanical and/or chemical treatments designed to best control weed species at a specific site.